





**Baltimore Medical College**

**LIBRARY**

*Presented by* .....

*H M Boylston*

*Date* .....

*5/2/12*



Digitized by the Internet Archive  
in 2013





Dr. J. M. BAXLEY,  
1126 North Avenue, West  
BALTIMORE, - MD.

## OBSERVATIONS

ON THE

## SURGICAL PATHOLOGY AND TREATMENT

# A N E U R I S M,

BEING THE SUBSTANCE OF

A COURSE OF LECTURES ON THAT DISEASE,

DELIVERED IN THE SCHOOL OF THE ROYAL COLLEGE OF SURGEONS IN IRELAND

DURING THE SESSION, 1839—40.

PART I.

BY WILLIAM HENRY PORTER,

PROFESSOR OF THE THEORY AND PRACTICE OF SURGERY IN THE ROYAL COLLEGE  
OF SURGEONS IN IRELAND, SURGEON TO THE MEATH HOSPITAL AND  
COUNTY OF DUBLIN INFIRMARY, AND CONSULTING SURGEON  
TO THE CITY OF DUBLIN HOSPITAL.

DUBLIN:

JOSHUA PORTER, 72, GRAFTON-STREET.

11639✓

Dublin: Printed by JOSHUA PORTER, 72, Grafton-street.

Cordell  
Hist.  
Coll.  
RC693  
.P84

AS A  
TESTIMONY OF RESPECT AND ADMIRATION  
FOR  
PROFESSIONAL TALENTS OF THE HIGHEST ORDER,  
AND OF  
AFFECTION AND GRATITUDE  
FOR  
EARLY, CONTINUED, AND ENDURING  
FRIENDSHIP,

THE FOLLOWING PAGES ARE INSCRIBED TO

JAMES W. CUSACK, M.D.

BY HIS OBLIGED AND FAITHFUL FRIEND,

THE AUTHOR.





## INTRODUCTION.

---

A short time previous to the winter session of 1839-40, some cases of aneurism occurred under my care in the Meath Hospital, attended with unusual symptoms, and followed by important, and, in some respects, unexpected results. It became, of course, my duty to endeavour to explain the nature of these cases to the pupils attending the institution ; a task which I found to be attended with more difficulty than I could have anticipated, in consequence of the vague and indistinct ideas entertained by many of them as to the pathology and treatment of even the simpler and more ordinary forms of the disease. It seemed, indeed, to be the prevailing opinion that aneurism consisted in some particular lesion of an artery, to be cured, if cureable at all, by one particular operation, the only objection to such operation being the situation of the disease in a locality where the vessel leading to it could not be

reached ; but, with respect to the existence of different pathological forms of the disease, and of the applicability of a suitable line of treatment to each variety, I discovered a good deal of incertitude or misconception. This deficiency, I confess, surprised me, when I reflected on the zeal and ability with which this branch of surgery has been of late years cultivated ; but I found there was still something wanted, some short yet comprehensive arrangement, founded solely on pathology, connecting each variety with the operation or other treatment adapted to it, and explaining (or at least endeavouring to explain) the circumstances that so frequently mar the best concerted operations and accelerate a patient's dissolution. These circumstances led to the construction of the following lectures, which I preferred to deliver in the theatre of the College of Surgeons rather than in that of the hospital, for two reasons—first, that in the pathological part I might have the advantage of illustrating my observations by the preparations in that splendid museum ; and secondly, that in the operative part I might be enabled, on the dead subject, to exhibit every necessary step, and explain every possible cause of difficulty.

Contrary to my expectations, this little undertaking occupied more time than I at first anticipated, or than could be spared from the other business of the course, as it embraced nearly twenty lectures, inclusive of the operations; this imposed an additional labour on me, but it was rewarded by the flattering request that these lectures should be published, to which I at once acceded, and they appeared, nearly in their present form, in our Irish periodical, the *Dublin Medical Press*. It will probably appear to many, that this degree of publicity ought to have been sufficient, as, perhaps, exceeding their merits, and to such I owe some apology for obtruding on public attention; but it has been suggested to me, that the pages of a periodical are not the sources from which students usually draw their information; that detached papers, however valuable, are seldom afterwards referred to; and that, if these observations are at all worthy of notice, they will be more so if collected into one continuous and connected whole: I have acted on these suggestions the more willingly, that it will be impossible for me, as indeed it would be unjust, to give the subject such extensive and undivided attention in any future course of lectures.

It would have been easy to have swelled out this little volume to twice or thrice its present size by lengthened details and an accumulation of cases, but this must have greatly interfered with my object in rendering the work accessible to every class of students. I might have embellished, and, perhaps, added to the value of the book, by lithographic sketches from the numerous drawings in my possession; but pathological illustrations fail in being useful unless most accurately coloured, and this must have entailed a still more injurious expense: I have, therefore, been obliged to confine myself to verbal description alone, and to an attempt to convey my ideas with as much conciseness as can be consistent with clearness of expression. It now remains only to say a few words on the arrangement of my subject. In the present volume my object is to treat of aneurism in its generic forms, (as far as is practicable) independent of the proper and peculiar features that may attach to it in any particular locality—to describe the different pathological conditions that precede and are supposed to conduce to the formation of the disease—to connect these with the symptoms as they arise—and to point out the mode of treatment apparently suitable to each variety.



Another object in which I am deeply interested is, to endeavour to ascertain how far our curative measures may be insufficient, and our operations unsuccessful, and to explain (to the extent our pathological information will permit,) the causes and circumstances that thus exert an unhappy influence on our practice. It would be, perhaps, impossible to carry out these views even imperfectly, without occasionally falling upon theory and speculation; but I have endeavoured to avoid these dangerous, though alluring paths, and it will be found that most of the opinions I have ventured to advance are built upon cases of recent occurrence, and which must still be fresh in the recollection of many of my readers.

How far I may succeed in this attempt to connect the precepts of practical surgery with pathological observation may be a matter of uncertainty, but should this preliminary essay be favorably received, it is my intention, in the second part, to consider the particular varieties of external aneurism, together with the operations that have been proposed and practised for their relief.

W. H. P.



# CONTENTS.

---

## HÆMORRHAGE.

	PAGE.
Lesions of an artery—hæmorrhage—aneurism, .. ..	1
Causes that modify arterial hæmorrhage, .. ..	2
Effect of the coagulation of the blood in controlling hæmorrhage— circumstances that influence it, .. ..	4
Structure of arteries, .. ..	5
Effect of its properties, .. ..	6
Hæmorrhage from a simply divided artery, .. ..	7
Operation of Nature in stopping it, .. ..	8
From a lacerated artery,.. ..	9
From one notched or only partially divided, .. ..	10
Effects of the adjacent structures on a bleeding vessel, ..	11
Theories of the process of Nature in arresting hæmorrhage—Petit— Morand, .. ..	13
Pouteau—Bell, .. ..	14
Real process two fold—temporary—permanent, .. ..	16
Methods of artificially arresting hæmorrhage—practice of the ancients,	19
Methods at present adopted, .. ..	21
Compression, .. ..	22
Objections to it, .. ..	23
Mode of applying it, .. ..	24
Ligature, .. ..	25
Effects of the ligature, .. ..	26
How to be applied, .. ..	28
Proposal of Mr. Lawrence, .. ..	29
Torsion—how applied, .. ..	<i>ibid.</i>
Cautery, .. ..	30
Styptics, .. ..	31

## ANEURISM.

	PAGE.
Definition, .. .. .	31
Varieties of, .. .. .	32
Etiology obscure, .. .. .	35
Experiments on animals useless, .. .. .	36
Some general facts connected with the production of the disease, ..	<i>ibid.</i>
Pathology of arteritis, .. .. .	39
Effects of arteritis, .. .. .	41
Case, .. .. .	43
Causes of arteritis, .. .. .	47
Formation of aneurism, .. .. .	49
Progress, .. .. .	50
Pulsation, .. .. .	51
Corollaries, .. .. .	52

## INTERNAL ANEURISM.

Symptoms of aneurism generally, .. .. .	53
Diagnosis—enlarged gland—abscess—encysted tumour—fungoid tumour, .. .. .	54
Bruit de soufflet, .. .. .	55
Symptoms occasioned by pressure—on a vein, .. .. .	56
On nerves, .. .. .	57
On bone, .. .. .	58
Terminations of aneurism, .. .. .	59
Cerebral aneurisms, .. .. .	61
Thoracic aneurisms, often overlooked or mistaken, .. .. .	62
Growth and progress, .. .. .	64
Symptoms, .. .. .	65
Case mistaken for laryngitis, .. .. .	67
Symptoms continued, .. .. .	68
Abdominal aneurism—may occur in the branches, .. .. .	70
In the aorta, .. .. .	71
Doctor Corrigan's observation on diagnosis, .. .. .	73



## TREATMENT OF ANEURISM.

	PAGE.
Processes of natural recovery, .. ..	75
Cases, .. ..	76
Principle of treatment, .. ..	78
Prognostics, .. ..	79
Indications, .. ..	<i>ibid.</i>
Valsalva's method, .. ..	80
Dupuytren's suggestion, .. ..	81
Effects of large bleedings, .. ..	82
Chemical agents, .. ..	83
Medicines, .. ..	85
External aneurism admits of different treatment according to cir- cumstances, .. ..	87
Cases for noninterference, .. ..	88
Case, .. ..	<i>ibid.</i>
Cases for amputation—carious bone, .. ..	92
Aneurism of large size, .. ..	93
Danger of the sac suppurating, .. ..	95
Earthy degeneration of the arteries, .. ..	96
Treatment by compression, .. ..	97
Cases, .. ..	98
Objections, .. ..	101

## TREATMENT OF ANEURISM BY LIGATURE.

Historical sketch, .. ..	103
Process of cure different in true and false aneurisms, ..	110
In the false, .. ..	111
Presse Artere of Deschamps, .. ..	<i>ibid.</i>
Effects of the ligature, .. ..	112
How the effused blood is disposed of, .. ..	113
True aneurism, .. ..	115
Pathology of a particular form of true aneurism, .. ..	117
Cases in illustration, .. ..	118
Process of cure in true aneurism, .. ..	121
Ligature at the distal side—principle of cure, .. ..	124

## DIFFUSED ANEURISM.

	PAGE.
Diffused and traumatic aneurisms, .. ..	127
Definitions of each, .. ..	128
Case, .. ..	129
Difference between circumscribed and diffused aneurisms, ..	130
Symptoms of diffused aneurism, .. ..	131
Three varieties of case, .. ..	134
Cases for amputation, .. ..	135
Cases for the Hunterian operation, .. ..	136
The artery to be tied above and below the aperture, ..	138
Traumatic aneurism, .. ..	139
Peculiarities, .. ..	140
Treatment, .. ..	141

CAUSES OF FAILURE OF AN OPERATION  
FOR THE CURE OF ANEURISM.

Conditions necessary to a cure not fulfilled, .. ..	145
Return of pulsation in the sac, .. ..	147
Two large trunks in the limb, .. ..	148
Branches communicating with the sac, .. ..	<i>ibid.</i>
The artery tied too loosely, .. ..	149
A too free anastomotic communication, .. ..	150
Dissection of a case of carotid aneurism that had been the subject of operation seven years previously, .. ..	151
Interesting case of carotid aneurism, .. ..	154
Similar case abridged from the <i>Medico-Chirurgical Review</i> , ..	163
These three cases compared, .. ..	165
A failure from anastomotic communications more likely to occur in the carotid than elsewhere, .. ..	166
Another difficulty attendant on carotid aneurism, .. ..	<i>ibid.</i>
Case, .. ..	167
Another cause of failure in the blood not becoming coagulated, ..	169
Cases in illustration, .. ..	170
Return of pulsation in consequence of inflammation of the vein, ..	172
Case and dissection, .. ..	174

## SECONDARY HÆMORRHAGE.

	PAGE.
Causes of this occurrence very obscure, ..	176
Divisible into two classes, .. ..	178
Symptoms of the first, .. ..	179
Hæmorrhagic fever, .. ..	180
Supposed causes—separation of the vessel from its connexions, ..	182
Objections to that theory, .. ..	183
Ligature placed near to a collateral branch, and objection, ..	187
Pathological exposition, .. ..	<i>ibid.</i>
Treatment when the bleeding has taken place, ..	189
Ligature of the artery higher up, .. ..	<i>ibid.</i>
Treatment of the case, .. ..	194
Consequences even when the bleeding is stopped, ..	195
Second form of consecutive hæmorrhage, ..	197

## ANEURISMAL VARIX—VARICOSE ANEURISM.

Definition of these diseases, .. ..	199
Conditions necessary to their production, ..	200
Abnormal state of artery and vein, .. ..	201
Case in illustration, .. ..	202
Disease first described by Doctor William Hunter, ..	203
Its treatment still undetermined, .. ..	204
Symptoms, .. ..	205
Pathology, .. ..	207
Some cases wholly incurable, .. ..	209
Principle of treatment, .. ..	210
Compression objected to by Dupuytren, ..	211
Valuable as a palliative, .. ..	212
Some cases must be operated on, .. ..	<i>ibid.</i>
The operation to be selected .. ..	213
Its difficulties, .. ..	<i>ibid.</i>
Conclusion, .. ..	214

---





# OBSERVATIONS ON ANEURISM,

&c.

---

## HÆMORRHAGE.

Causes that modify arterial Hæmorrhage—Influence of the blood in controlling it—Influence of the Arteries—Different Phenomena of Hæmorrhage—Process of Nature—Theories—Temporary—Permanent—Varieties—Artificial methods of suppressing Hæmorrhage—Compression—Ligature—Torsion—Cautery—Styptics.

In order to obtain a simple, and, at the same time, a correct idea of the pathology and treatment of aneurism, it will be necessary to take a general view of the different lesions of an artery which, by impairing the continuity of the tube, permit the escape of the circulating fluid from it. These will be found to exist in two different conditions—different often in the exciting cause—always in the symptoms and progress of the case, and also in the adaptation of remedial measures, although I shall endeavour to show that the principle of treatment is identical in both. The first of these (technically denominated hæmorrhage) involves not only a lesion of the vessel, and the escape of the blood from it, but the existence of an external communicating wound, capable, both by extent and direction, of allowing the whole, or the greater part of the fluid, to pass from the body altogether.

## 2 CAUSES THAT MODIFY ARTERIAL HÆMORRHAGE.

ther: the other (termed aneurism) is where there is such a lesion of the vessel as will permit of the withdrawal of a certain quantity of blood from the ordinary and healthy channel of circulation, but not from the part or limb in which the diseased or injured vessel is situated. This latter, which may present a number of varieties, according to the pathological condition of the artery, and the quantity, situation, and state of the effused blood, forms the legitimate subject of our inquiry now; but as it is generally preceded by, or at least attended with, a diseased condition of the vessel, it may facilitate our progress first to take a short review of the phenomena of hæmorrhage, which, being almost always occasioned by wound or other injury, will be more likely to occur to an artery otherwise healthy, in which the process of restoration and recovery can be more easily observed.

Arterial hæmorrhage, both in its progress and termination, presents considerable variety, according to a number of circumstances, with each of which it is necessary to be familiarly acquainted, in order to be able, not only to recognise the nature and extent of the evil at once, but to adopt the treatment most judicious and most applicable to the individual case. Thus, it will be found that the peculiar quality of the wound itself, or rather of the substance or weapon by which it has been inflicted, will considerably modify the symptoms and the danger; the wound of an artery by a cutting instrument being very different from that inflicted by a blunt one or by cautery. The extent of the lesion to which the

artery has been subjected, also causes an important modification; it making a vast difference whether the vessel is wholly divided through its transverse diameter, or only partially cut or notched. It is also of consequence to remark that the structure in which the artery is situated exercises a remarkable influence on the phenomena of hæmorrhage, and it will not be difficult to show hereafter that the circumstance of a vessel being imbedded in a lax and yielding cellular tissue, or in a structure rendered firm and solid by the presence of coagulable lymph, will cause the greatest practical differences. The importance to be attached to the wound of a large vessel over that of a small one, is too obvious to require to be pointed out to the youngest practitioner. Lastly, the extent, and more particularly the direction, of the external wound may, in facilitating or preventing the entire escape of the blood from the part, more or less cause the case to lose the character of hæmorrhage, and assume that of aneurism, as already noticed. Here, then, are some of the most prominent circumstances that influence the result, and modify the symptoms occasioned by an artery being wounded, and as nature is in many instances capable of repairing the accident, wholly unaided by art, and in others not so, it is probable that there must be different means applicable to each emergency. It is the province, as well as it is the duty, of the practical surgeon to investigate the operations of nature in all these different circumstances, as it is thus only he can hope to be enabled to afford assistance, when her own efforts prove insufficient.

As the importance of the blood to the support of animal life is so great, that any sudden or extensive withdrawal of it from the system uniformly endangers existence, if it does not destroy it, so the most wise and provident precautions are taken to guard against such an occurrence as the result of accidental injury. Thus, it is found that the natural and healthy qualities of the blood itself, and of the artery from which it escapes, are the agents by which the object is effected. It is familiarly known, that no sooner is blood poured out from any vessel, than it has a tendency to become coagulated, and the coagulum or clot thus formed, placed at the orifice of the vessel, and mechanically blocking it up, is obviously most efficacious in preventing any farther loss—and hence any circumstance known to be favourable to the coagulation of the blood, is also known to be useful in controlling hæmorrhage. Hunter found by experiment that rest and exposure to the air were the circumstances under which the coagulation of the blood took place most quickly. Now, nature provides for the repose of the blood—1st, by its being entangled in the cellular tissue—2d, by the gradual diminution, as it flows, of the size and velocity of the stream—3d, in cases of a large or a rapid abstraction of blood, by the occurrence of syncope, which, weakening or withdrawing the impulse of the heart from the circulation, generally affords sufficient time for the clot to be formed without disturbance; and, 4th, by the rapidity with which the blood coagulates. The influence of exposure to the air, in stopping hæmorrhage, is too obvious to require proof.

Every student has seen cases in hospital after operation, in which a hæmorrhage, that took place when the patient had become warm in bed, was controlled by little more than the removal of the dressings, and the opening of the wound. But there is a beautiful provision which alone would be sufficient to prove that the coagulation of the blood was intended to prevent the loss of that important fluid. Jones, in his sixth experiment, found that a tea-cup full of blood, taken immediately after the division of an artery, coagulated in five minutes and a few seconds—the same quantity, taken a quarter of an hour afterwards, (by which time the animal had lost an immense quantity of blood, and appeared very faint,) coagulated in three minutes and a half. Thus, it appears, that in proportion to the loss of blood, and the imminence of the danger, is the tendency of that fluid to coagulate increased, and the chief, if not the only resource that is eventually to preserve life, furnished when most required.

But further, the arteries are found to possess certain properties or qualities, which are eminently useful in suppressing hæmorrhage. An artery, in its healthy condition is generally composed of three coats or membranes—an internal lining membrane, a middle fibrous coat, and an external cellular: according to Hunter and Jones there are four coats, the fibrous being by them divided into the elastic and the muscular. The internal lining membrane is smooth, shining, and polished, bearing in appearance some analogy to serous membranes:



it is of a pale yellow colour, approaching to pink, and, in its ordinary condition, seems destitute of vessels; but its occasional liability to disease, its extreme activity in the repair of injury, its appearance when inflamed, and the results or products of such inflammation, are incontrovertible evidences of a tolerably high vascular organisation. The middle or fibrous coat is that to which the artery is mainly indebted for its strength: it is of a pale yellow colour, and has some faint resemblance to a ligament in structure. Without entering upon the long-disputed question as to whether an artery possesses a muscular coat or not, (a question that ought never to have been raised, when it was observed that many living structures besides muscle were endowed with contractility,) it may be remarked that it possesses some such power resident within this fibrous coat. Thus, an artery in its normal state is capable of accommodating itself to the quantity of its contents: that is, it is increased or diminished in diameter according to the dimensions of the column of blood circulating through it, being at all times completely filled; and when divided, it retracts and withdraws itself from the surface of the incision, and also contracts and diminishes in size. The external or cellular coat is generally composed of reticular membrane, which is scarcely endowed with contractility, and is not in any situation very highly organised, yet it nevertheless plays an important part in disease, and more particularly in the suppression of hæmorrhage. These different qualities, appertaining to the arterial structures, however useful in assisting to control hæ-



morrhage, are really more valuable in placing the vessel and the blood in a condition favourable to the cessation of the bleeding, than in actually causing it to cease. It is not the contraction of the vessel that stops the bleeding, (although it might do so in the instance of a very small one,) because it is too slow a process; but it is useful, by diminishing the size of the wave of blood, and the impetus with which it would be driven against the coagulum about to be formed: neither is it the retraction, although this too is of use, because the withdrawal of the fibrous coat leaves a portion of the cellular, ready to receive and to retain the blood which is to form the clot. Here, then, are the qualities or properties, both of the blood and of the vessel, working in a wise and beautiful combination to arrest the flow of that fluid, the loss of which is necessarily destructive to life.

Having thus explained the circumstances that chiefly contribute to the natural cessation of hæmorrhage, I come now to examine how far they are influenced by the peculiarities of the different cases to which I have already adverted.

When an artery of moderate size is divided in a wound so open and patulous, (on the face of a stump, for instance,) as to permit the free escape of the blood, there is at first a large and sudden gush of blood, after which the fluid seems to come with jerks, or, *per saltum*, the open mouth of the vessel being clearly to be seen. After a few minutes, the vessel withdraws itself from observa-

tion, the blood flows out in a more continuous stream, without any impetus, in a current of a diminished size, and seems to proceed from a deeper part of the wound. In a short time afterwards, the bleeding stops; and if an opportunity offers of examining the parts, the following appearances are observed:—The divided extremity of the vessel will be found to have contracted in diameter, and this contraction is inversely as the calibre of the vessel, being so perfect and so forcible in the small one as often to close the orifice completely—so trifling in the larger, as frequently not to be appreciable. This contractility first led to the opinion of the fibrous coat being muscular, but it is very different from the rapid and decided contraction of a muscle, being slow and gradual in its operations; and hence a vast quantity of blood might be lost from a vessel of even a moderate size, before the diminished calibre of the divided orifice could, of itself, offer any material impediment to its escape. The fibrous coat of the artery has also retracted within the cellular, and there are two coagula of blood formed—one external, consisting of the blood that has been entangled in the cellular sheath of the vessel, and thus brought to press directly on its orifice—the other internal, to which more importance has been attached than it probably deserves, but which, for that very reason, must be noticed. It is of a conical shape, the base of the cone lying at the divided extremity, the apex at the spot where the nearest collateral branch is given off. It never occupies the entire calibre of the vessel, and, consequently, cannot block it up mechanically; and as its

presence or absence depends on the distance between the wound and the next branch, it should follow, if it is instrumental in controlling hæmorrhage, that an artery divided close to such branch would never cease to bleed. This is by no means found to be the case, and therefore are there grounds for believing that the existence of an internal coagulum is more or less accidental, and not in any respect necessary, or even important.

Arteries that have been injured by rough and blunt instruments, and are thus lacerated rather than cut, seldom bleed; but it is a mistake to suppose that such an occurrence does not occasionally take place, even to the loss of life. Thus, in general, where a limb has been torn by a cannon-shot, or by machinery, no very great expenditure of blood is to be expected, although the vessels may be seen hanging from the wound, and pulsating almost up to their divided extremities—their mouths sometimes completely open, sometimes slightly contracted, or filled by a small coagulum. The process by which the hæmorrhage is prevented in these cases has never been sufficiently or satisfactorily explained, although, to a certain extent, it has been practically imitated; but whatever it is, it certainly is not always efficacious. Not long since, a man was brought into the Meath Hospital, whose fore-finger was broken and lacerated in a steam-engine—he resisted amputation, and for two days this apparently trifling wound poured out blood with a violence absolutely uncontrollable. At length he submitted to the operation as the only means of saving

him from bleeding to death; and from the clean incised wound thus made, not a drop of blood flowed—neither was it necessary to tie a single ligature. Very recently, in the case of a man whose arm was torn off by a steam-engine, the main artery of the limb hanging from the wound bled with a degree of violence that was nearly fatal before he could be conveyed to hospital. It appears, then, that the means adopted by nature to control hæmorrhage are not the same in this case as when an artery is simply divided by a cutting instrument, and that they are not uniformly brought into operation; but as these means are not understood, neither is it possible to explain the causes of the different phenomena that occur under circumstances so apparently similar.

When an artery is only notched or partially divided, it is obvious that the material steps of the process already described cannot be completed. It is probable that every wounded artery contracts to a certain extent, because an experiment of Hunter's shewed that the posterior tibial artery of a dog, if laid bare, may become contracted to apparent obliteration, and there is no reason to suppose that simple exposure would be a more powerful stimulus than an actual wound or puncture: but, nevertheless, it does not appear from observation, that the contractile force is always sufficient to close up so small a vessel as a branch of the temporal; and it has been already shown that it is not the most valuable or efficient part of the process. Neither can an artery thus circumstanced retract within its sheath completely:

on the contrary, the little retraction that takes place is confined to the injured side of the vessel, and the slit-like wound is thus converted into a round and patent aperture, pouring out blood at every pulsation of the heart, and incapable of being closed by any known operation of nature alone. Again, as there is not retraction, there cannot be any portion of the cellular coat left beyond the wounded extremity of the vessel in which the blood might be received and entangled, and consequently there cannot be any external coagulum. Here, then, the different processes that are found to operate so beneficially in cases where the vessel is completely divided, are either valueless or decidedly injurious, and the result is so obvious, as to be capable of illustration by an event that takes place almost daily in hospital and dispensary practice. A temporal artery, that has been opened by surgical operation, very frequently continues to bleed with nearly incontrollable obstinacy, defying every contrivance of compress and bandage that the young pupil can apply, and alarming him by bursting out again and again in repeated hæmorrhages: in this condition the surgeon knows that the vessel has been only notched; and when he is about to stop the bleeding he places it in a state in which it can contract and retract, and a coagulum be formed: he divides it completely by a stroke of a lancet carried down to the bone, and the hæmorrhage ceases instantaneously.

Having thus seen that when an artery is situated in a lax cellular tissue, so that it may contract and retract,



and a coagulum thus be formed with facility, it is by the intervention of these processes that the hæmorrhage is stopped, we now turn to observe the influence of structure in an opposite direction, and find that where the vessel is situated in a part devoid of cellular tissue, or otherwise so circumstanced that they cannot be brought into operation, it will pour out its blood almost to an indefinite extent. Thus, on ulcerating surfaces, where the artery is surrounded and fixed by coagulating lymph, if it happens to be opened, either accidentally or by the progress of the disease, it will probably continue to bleed to an alarming and dangerous extent. In a case of phagedenic chancre, nothing is more common than to see a patient's bed soaked with blood, proceeding from a vessel opened by the separation of a slough, the diameter of which, after all, may not be greater than that of a thread of sewing silk. In like manner, arteries situated in hard and firm cicatrises, cannot retract, and will, if wounded, continue to pour out an unceasing flow of blood. This I have more than once experienced in enlarging an aperture into the trachea, that had gradually become contracted and cicatrized. Other facts may be brought forward in illustration of this principle, but sufficient has been stated to show the paramount importance of an external coagulum: afterwards, certainly, there must be provision to prevent the recurrence of the hæmorrhage when this clot shall have been removed by the absorbents; and, accordingly, there is a subsequent process of inflammation, effusion of lymph, and obliteration; but as the first and most immediate means of restraining hæmorrhage, the formation of a coagulum is chiefly to be looked for.



It is worthy of remark, that the first theory formed on this subject was founded on the coagulation of the blood. To this cause the natural cessation of hæmorrhage was attributed in 1731, by Petit, who observed that there were two coagula formed, one outside the vessel, which closed it up, and the other within, which, he supposed, might operate as a plug. It is needless, at this day, to pause for the purpose of examining a theory so very imperfect--yet, with all its faults, it has the merit of being the first, and is, of course, the foundation upon which any scientific superstructure has since been raised. About the same time, or shortly afterwards, Morand promulgated a theory, admirable for his time, and which, as to facts, is nearly correct and true. He admitted the coagulation of the blood, but could not concede that it was alone sufficient to restrain arterial hæmorrhage: he looked farther, and found that the vessel contracted within its sheath, and that it became narrowed in diameter by a corrugation or plaiting of its fibres. His language was very imperfect. He sometimes spoke of the frowning of an artery, as if it was thrown into rugæ, like the wrinkles on the forehead of an angry man. How this effect was produced he was unable to explain. He spoke of longitudinal fibres in the vessel; and, in short, his theory was physiologically imperfect, whilst practically it was nearly true. And, after all, although more than a century has elapsed, how far can he be considered to be inferior to surgeons of the present day? He observed the retraction and contraction of an artery, but could not explain how these things happened: we

mark the same phenomena, but are divided as to whether we can concede to the vessel any muscular contractility or not. He was followed by Sharp, by Kirkland, and other English surgeons, and his opinions form a part at least, of every doctrine entertained on the subject since, excepting only that of Pouteau. This latter denied the sufficiency of the coagulum to restrain hæmorrhage, said that a contraction and retraction could not be proved, and set about a course of experiments in order to determine the question; but, like other experimentalists, he seemed previously to have constructed his theory, and consequently passed over every result excepting such as might serve to strengthen and confirm it. He said, that hæmorrhage is stopped by the tumefaction of the surrounding cellular membrane, and that he found it so shortly after the infliction of the wound; but in this he mistook the swelling which results from inflammation, and which, of course, will require some time, for the rapid and decisive operation of nature, that must be performed immediately, or the patient perishes. In short, all these inquirers took but a partial view of the subject. Petit, Morand, and others, saw only that which occurred soon after the wound had been inflicted, and which prevented immediate death from hæmorrhage: Pouteau saw that which happened afterwards; and all parties were right so far as they went, but not one was sufficiently comprehensive. I pass all subsequent theories, founded more or less on those already mentioned, and proceed to that of the late celebrated John Bell. In a vein of humour peculiar to

himself, and which rendered him the most dangerous critic to which any author or any opinion could be subjected, he swept away all that had preceded him, and in their place attempted to substitute an hypothesis which will scarcely bear examination much better than any of those he desired to remove. He says :—"When an artery is wounded, the stream of blood gradually lessens, because the vessel is emptied, and the resistance to the arterial action is removed." He then says that—"as the stimulus is removed, the blood forsakes the open artery, and passes by the collateral branches." Now, the obvious meaning of these passages is, that the impulse communicated to the artery, by the blood passing through it, is actually the cause of the circulation, and when this impulse is removed, the blood no longer traverses the vessel, but is diverted into the collateral branches; and if this be true, it follows that there should never be hæmorrhage at all—for the mere act of dividing an artery should send all the blood by the accessory circulation. Further, he says that "the surgeon claps his finger on the mouth of an artery, which prevents external bleeding, and the blood is then injected into the cellular membrane, coagulates there, and the hæmorrhage is thus restrained." But there is some slight mistake here. The very essence of the inquiry is, as to the manner in which bleeding is stopped, when there is no surgeon present—no assistance to be derived from art—and yet the surgeon's finger is introduced as one of nature's implements: and again, it was not consistent to ridicule Petit for imagining that a clot of blood could be efficacious in

such a case, and then advance, that “the cellular membrane is injected with blood,” which, if it at all prove useful, must be by coagulating—or, in other words, forming a clot.

I consider that the process by which hæmorrhage is perfectly and permanently controlled should be divided into two stages, one immediate, or, as it should be more properly termed, temporary—the other more remote, but permanent, by which a recurrence of the bleeding at any subsequent period is provided for and prevented. The first of these is effected by the application of pressure to the mouth of the bleeding vessel—it may be by the contraction of the orifice of the vessel, as Mr. Guthrie supposes to be the case in arteries injured by laceration—it may be by the formation of a coagulum, as is more obvious to our observation in simple incised wounds—still in each and every case, Nature seems to employ pressure as her first resource. The second step is the establishment of inflammation in order to lead to the total obliteration of the vessel subsequently. Both these processes are necessary to the safety of the wounded man. If the vessel is so circumstanced that this pressure cannot be applied—or, being applied, if it is relaxed or removed—or if the second process is not completed or is imperfect, the bleeding will return sooner or later, and is then known by the appellation of secondary or consecutive hæmorrhage. Thus, soon after the cessation of the bleeding, and the formation of the clot, coagulating lymph is effused at the extremities of the divided vessel,

which attaches the base of the internal coagulum to the circumference of the wound, and if allowed to become consolidated, forms a tolerably efficient barrier against the recurrence of hæmorrhage. The blood begins to circulate through the collateral branches, which, at a very early period become enlarged in order to accommodate themselves to the performance of their new functions, whilst all that portion of the vessel between its division and the next collateral branches above and below begin to contract in diameter—the internal coagula are absorbed—and, finally, these portions of the vessel become impervious, and degenerated into little more than ligamentous cords. There is a curious circumstance connected with this subject that must be noticed, although it cannot be explained. When an artery has been divided, and ceases, spontaneously, to bleed, the process by which such bleeding is controlled is always more perfect in the superior or cardiac section than in the inferior: that is, if the femoral artery, for instance, is wounded, and the bleeding ceases for a period, and then bursts forth again, it is almost invariably, and without exception, the inferior portion that bleeds—no matter whether the consecutive hæmorrhage be soon or late—at a near or a remote period from the infliction of the injury.

But it may be asked—Are the processes just described the same by which an artery that is only notched heals subsequently—or is it a matter of necessity that a vessel once opened in any manner must con-



tinue to bleed, unless its calibre is obliterated? On this subject I have met with a considerable diversity of opinion, and there has not been a sufficiency of evidence collected to decide the question satisfactorily. Many persons, for whose practical experience I entertain the highest respect, believe that an artery so circumstanced may heal without obliteration. Dr. Jones details three experiments, the results of which would show that the arteries of dogs, if only divided to the extent of one-third of their circumference, heal without their calibres being even diminished; but with reference to this point it must be remarked that the arteries of inferior animals do not, either in their physiological or pathological qualities, resemble those of man, and therefore, (to say the least of them,) all such experiments prove nothing in explanation of the process of repair in the human subject. Again, a case of aneurism, at the bend of the arm, and produced by the puncture of a lancet in bleeding, was treated by compression in Stevens's Hospital, and recovered; the artery remaining perfectly pervious through the entire of its course: but in this case the vessel passed in front of the tumour, and the only way in which a connexion between them could be explained was by supposing the lancet to have transfixed the vessel, the anterior wound to have healed, and the posterior to have formed the aneurism. But this is stretching imagination beyond probability—and it is far more likely that the artery which passed in front of the tumour was the radial which came off, (as it frequently does,) very high up, whilst the ulnar, occupying the usual



situation of the main trunk, had been wounded, and the aneurism, in increasing in size, pushed forward the radial on its surface. Under all circumstances, however, and fortified by the uniformity and simplicity with which nature performs her operations, I freely acknowledge that I do not believe a wounded artery ever heals unless by obliteration. Already it has been shewn that in an open and patulous wound, a notched artery will bleed to a terrific extent, merely because it cannot retract, and a coagulum cannot be formed. I have known death to be the result of such a wound of the *anastomotica magna*, near the condyle at the elbow, in a case that was left without assistance; but in these countries, such cases very rarely occur—the loss of blood invariably creates too much alarm to admit of such neglect—something is wrapped about the wound—some artificial pressure is made, and then the case ceases to be one in which the unaided efforts of nature can be appreciated.

Of these two processes the first is the only one that can be imitated or assisted by art—the second is a vital action but little under the control of the surgical practitioner; accordingly it sometimes fails, and when it does so, occasions one of the most troublesome cases to be met with in practice. I confine myself, therefore, in the present instance, to the measures usually adopted to control bleeding on its first occurrence—secondary hæmorrhage will be treated of hereafter.

The older surgeons, ignorant of facts now so generally

known, and apparently so simple, must have been fearfully alive to the dangers of hæmorrhage—dangers which they knew not how either to combat or avoid, and which rendered the consequences of their operations more formidable than the operations themselves. Of course all their discoveries proceeded from accident or empiricism, as they could have no principle to guide them, and yet it is worthy of remark, that as most of their contrivances were resolvable into pressure, so are they occasionally resorted to at the present day. Their chief reliance was on fire—they plunged a red-hot iron against a spouting artery, or cut off a limb with a heated knife; ignorant that the eschars thus produced pressed upon the vessels, and so prevented bleeding. They used styptics, and employed agaric and sponge, without knowing how either happened to prove useful. In short, their entire practice was empiricism, and they adopted their several means without caring much as to their mode of operation—even Ambrose Parè, who discovered the use of the ligature, received it as a revelation from Heaven, and never troubled his mind farther about the matter. We, occasionally, at the present day, resort to these different modes of treatment, the great and striking difference being, that as we have some principle to govern our practice, we adapt each mode of applying pressure to the case to which it is particularly suitable. Thus, the object being to prevent the flow of blood for a sufficient time to allow of the establishment of inflammation, we endeavour to select that form of compression which is least painful in its application, and least

doubtful in its result. The methods by which this can be accomplished may be arranged under the following heads :—

1. Pressure, by means of compress and bandage, or by mechanical instruments.
2. Pressure, by ligature.
3. Pressure, by torsion.
4. Pressure, by the application of styptics.
5. Pressure, by the formation of an eschar.

1. Whatever predilection a surgeon may entertain for the ligature, he, nevertheless, will meet many cases in which he will be disposed to try compression, and some in which he can have no other resource. Thus, his business may be with a patient who has an unconquerable dread of the knife, and who will steadily refuse to submit to those incisions that are almost always requisite to expose a wounded artery, so that it may be tied with safety. Or the wounded vessel may lie deep—or it may be of such size as to encourage a reasonable expectation of the bleeding not proving very profuse—or there may be nerves, or other very important parts liable to be injured—or the accident may have happened at night, and in a situation where it might be impossible to procure light and the assistance necessary to the performance of a very delicate operation. I pass over cases where there may be reason to suspect a diseased condition of the vessel, and the still more dreadful cases of secondary hæmorrhage, where the ligature had been

already tried and failed. Independent of these, the recent cases are numerous, in which a surgeon is obliged to trust to compression and bandage, and the success that occasionally attends this practice will appear surprising when the difficulties and dangers that accompany it are considered.

If we reflect on the subject physiologically, it appears necessary, in order to the perfect compression of an artery, that the vessel should be small in size, and situated superficially, for if a strong muscle intervenes, its contraction will be sufficient to raise the compress and allow the vessel to bleed internally. The artery should lie upon a bone, so as to afford a counter-resistance to the pressure from without—there should be no accompanying vein, nor indeed any vein in the neighbourhood through which the current of blood could be intercepted by the compress—there should be no accompanying nerve—in a few words, the artery should be small and healthy, superficial, insulated, and resting on a bone, and a very slight anatomical reflection will shew how few the arteries are that are so fortunately circumstanced. Even in the most favourable cases, there are still some apparent difficulties. The compress and bandage ought to be applied so tightly as to lay the opposite sides of the wounded vessel fairly in apposition, and in general this occasions such a degree of pain that few patients, (once the actual terror of bleeding to death has passed away,) will, or even can, endure it. All bandages will stretch and become loose—the patient will shift

about and endeavour to alter its position and its bearing—and I have known one who actually took it off. If the bandage is too loose, it may not controul the bleeding, or, what is worse, preventing it from appearing without, it may permit the vessel to bleed internally, and in a few hours the surgeon, summoned by the agonising distress of his patient, finds the limb swollen, its cellular tissue in every direction injected with blood, and the entire ready to fall into gangrene. If, on the contrary, the bandage is too tight, and particularly in persons of bad habit and debilitated constitution, the pressure necessary to controul the bleeding may occasion mortification of all the structures beneath it. Of all the arteries in the body, the temporal has been justly considered to be that which may with most safety be entrusted to pressure, yet even here very calamitous results are by no means improbable. Soon after the application of the bandage, the patient complains of intense pain, and when the dressings are removed, the integuments are found in a state of erisypelatous inflammation, threatening to run into gangrene—the wound opening, and the blood bursting out again; when (as I have unfortunately witnessed,) the compression is re-applied, it only hastens the mortification without at all controlling the bleeding, and nothing that the patient can endure will restrain the hæmorrhage, which is profuse, and often periodical, until that condition of constitution is established, known by the appellation of hæmorrhagic fever; at last, perhaps, the trunk of the artery is tied at a distance from the slough, and such an operation may



succeed, but, in consequence of the freedom of anastomosis among the branches, is far more likely to fail. Thus harassed and broken down, pale and exsanguine from repeated losses of blood, either the patient dies at an early period, or the foundation is laid for dropsy, consumption, or some other disease that will eventually carry him off. This is a sad picture of events, and unfortunately it is sometimes a true one, but not by any means so frequently as a mere theoretic reasoning on the subject might lead us to believe: in practice we find the treatment by compression tolerably successful, and that, too, in situations, and under circumstances, that might not always be anticipated.

When compression is resorted to for the purpose of controlling hæmorrhage, a graduated compress is to be placed exactly over the aperture in the bleeding vessel, and secured there by a bandage, rolled so evenly, that no one part of the limb is subjected to greater pressure than another; and so firmly as to lay the opposite sides of the vessel fairly in contact, but, at the same time, occasion as little pain as possible. This is generally accomplished by a comparatively moderate degree of pressure, and I believe the important point to be attended to is the evenness of the bandage rather than the force it exerts. In the arm, for instance, which is frequently the seat of this operation, in consequence of the artery being punctured by an awkward and ignorant phlebotomist, the bandage should commence with the fingers, each of which should be rolled separately and firmly, it

must then be carried evenly up the arm, and terminate a short distance above the position of the compress. The arm should then be laid upon a pillow, and the patient receive the strictest injunctions not to attempt to move it. For some hours the case will require the most watchful attention on the part of the surgeon. If there is no increase of pain, or throbbing, or other uneasiness, the compression will probably succeed, and I believe many an individual has had the brachial artery opened without ever entertaining a suspicion that he had been exposed to so much peril: if there is this increase of pain or tension, the arm must be opened and examined lest bleeding should be going on internally. This is a most fearful accident—it constitutes the disease termed traumatic aneurism, and is of such importance as to demand separate consideration hereafter.

2. Notwithstanding our acquaintance with the resources of nature, and the assurances of military surgeons, that hæmorrhage from a middle-sized artery need not create alarm, we uniformly endeavour to control it with the least delay possible; and although compression can, as I have shown, so frequently be made available, we always, when practicable, prefer to tie the vessel. In this way, mechanical pressure is applied directly on the spot we choose to select; it is firm, and, if properly tied, incapable of being disturbed; and requires not the irksome and often painful apparatus of compresses and bandage, which may stretch, or otherwise become loose, and are then either utterly useless, or cause disturbance



to the patient by their repeated application. A ligature also places the artery in a condition the most favourable to the production of that inflammation which is subsequently to occasion its obliteration; and although it sometimes fails, and is even followed by consequences of a most formidable nature, yet in general it is the most secure, and, therefore, the most satisfactory line of practice.

When a ligature is thrown round an artery, the first effect is to approximate its opposite sides closely together, and, of course, arrest the flow of blood through it. When tied with a sufficient degree of tightness, the internal and middle coats are divided completely through, and the cord is kept in its place by its hold of the cellular tissue compressed within its small noose. This division of the internal and middle coats was held by Jones to be indispensable, inasmuch as when it did not occur the artery failed to become obliterated in consequence of the absence of the process of inflammation: his experiments, however, were all made on the inferior animals, and I have already noticed the fallacy of the conclusions to be drawn from them. In the human subject, the internal and middle coats are so brittle that it would be difficult to tie an artery without cutting them through: yet it is not necessary that this should happen. I have seen instances in which an artery was obliterated by the pressure of the "presse artère"—(an instrument to be described hereafter)—it is familiarly known that it may become so from compression artificially applied

by means of bandage ; and the influence of tumours in the same way incontestibly proves that an artery may go through the entire process from inflammation to obliteration without its coats being so divided. I am not objecting to the practice of tying a ligature tightly ; for, I believe, it is the best mode of ensuring that inflammation on which the success of the operation depends, and I have always adopted it myself ; but merely stating as a pathological fact, that the division of these coats, however useful, is not always absolutely necessary. Coagulating lymph is then thrown out within the vessel from the edges of its divided coats, or from the surface of the divided membrane, and a clot is formed internally, of the size, shape, and extent with that which has been already described as occurring within a wounded vessel about to be healed by the operation of nature alone. The blood that is destined to nourish the limb now begins to flow through the collateral branches, some of which become proportionally enlarged, whilst the intercepted portion of the trunk, between the ligature and the next branch, is diminished in calibre ; and, finally, although at a remote period, degenerated into a ligamentous cord. In the meantime, the absorbents must remove the living portion of the cellular coat of the artery immediately in connexion with the little slough within the noose of the ligature—a process that is completed within a longer or shorter time, according to the size of the vessel, and then, so far as its mechanical compression is concerned, it might be withdrawn ; but it is generally held more or less firmly by granulations

that are found in the adjacent parts of the wound—there is peril in pulling it prematurely, or otherwise interfering, and it will be better to leave it to be thrown off by suppuration, or until a confidence exists amounting almost to certainty, that the healing process has been completed.

In order to secure an artery that has been perfectly divided, each segment should be seized with a tenaculum or forceps, gently drawn out from the surrounding cellular tissue, and held whilst an assistant ties up the mouths of the vessel with a round ligature properly prepared. In every instance, with one exception, the vessel should be completely insulated, and nothing but itself included within the cord: that exception having reference to the arteries of old persons which have become rigid and contain a quantity of earthy deposit, and are apt to break off during the operation of seizing and drawing them out. This may render it excessively difficult to secure such a vessel, and, in such a case, it will be advisable to include some of the adjacent softer tissues, (always excepting a nerve or a vein, which, under every disadvantage, ought to be avoided,) and the patient thus treated, in general, progresses very favourably. From inattention to this precaution, I have more than once seen great difficulty and delay in securing the arteries of a stump after amputation, and the operator at length obliged to resort to deep plunges of the needle. As one end of the ligature must be left hanging from the wound, in order to its withdrawal afterwards, it is

evident that until its removal the wound cannot be made to unite by the first intention, and where there are many of them, as on the face of a stump or other extensive surface, their presence, acting as so many setons, keeps up irritation, and often a profuse discharge. To obviate this inconvenience, it would be desirable to suggest some plan, which, whilst it might be sufficient to control the bleeding, should also permit the perfect closure of the wound.

In 1814, Mr. Lawrence proposed to tie the vessels, in such a case, with fine silk ligatures, cutting off the ends as close to the knots as might be consistent with security, and detailed several instances of such practice in which the wounds healed kindly, and the small nooses were never afterwards seen or heard of. I have seen this practice adopted with very considerable success, and have myself, in cases of extirpation of the mamma, frequently employed ligatures of thin cat-gut and cut off the ends close to the vessel, and certainly have witnessed very gratifying results; but I would not be disposed to entrust a large artery either to very fine silk or to cat-gut, and with respect to the smaller branches, I believe the comparatively modern practice of torsion to be decidedly preferable to either, if properly, or, I should rather say, dextrously performed.

3. The proposal of controlling hæmorrhage in this manner originated with Amussat, a surgeon of high reputation; and the object of the operation seems to be to

place the vessel in the same or a similar condition to that which would have existed if it had been divided by gun-shot or other lacerating force. To accomplish this purpose, the vessel is seized, drawn out, and carefully insulated from the surrounding cellular tissue; it is then, by means of a forceps contrived for this purpose, twisted on its own axis, until its extremity is torn and broken up—the broken portion forming a knot or knuckle on its extremity, which mechanically blocks it up. The residue of the process is said nearly to resemble that which should ensue on the application of a ligature. As a mere means of controlling hæmorrhage from small vessels, I am favourable to torsion, because I have practically experienced its value, but it is right to mention that some dexterity (perhaps only to be acquired by practice,) is requisite for the performance of this operation: frequently have I seen the entire extremity of the artery twisted off, and the blood continue to flow.

4. Lastly, it may happen that an artery shall be wounded in a situation that cannot be reached, as in operations about the antrum, the root of the tongue, or other parts of great depth or intricacy. Under such circumstances, there is no resource but the actual cautery, and in general it is very successful. It acts by producing a slough, which, lying on the mouth of the vessel, closes it for a time, during which the process of inflammation within it tends to its permanent obliteration. When this latter does not occur, or is but imperfectly performed, the vessel bleeds again on the separa-



tion of the slough, and constitutes one of the most unpleasant and unmanageable forms of secondary hæmorrhage that we have to deal with. On the contrary, where the bleeding is superficial and extensive—where there is a general oozing, and no distinct vessel can be discovered, a reliance may be safely placed on styptics, accompanied by a moderate degree of pressure. Of these there has been a great variety, and each in its turn held its day of celebrity; but nothing can more satisfactorily prove their inefficiency in really important cases than the ephemeral reputation they enjoyed. They have now, (except in the cases just alluded to,) all given place to the ligature.

## ANEURISM.

Its Nature—Different Species or Varieties—Supposed Causes—Pathology.

Aneurism, according to the modern and restricted acceptation of the term, implies such a condition of an artery as will permit a portion of the blood to be withdrawn from the usual channel of circulation; it, therefore, as far as the artery is concerned, only involves a lesion of the vessel of such a nature as will allow of the escape of this blood. But this blood may be placed under different circumstances, and the condition it is in, and the position it occupies, form very important features in the nature and treatment of the disease. Thus, although still retained within the limb or part, and in the immediate neighbourhood of the vessel from which



it flowed, the blood may be coagulated, incapable of ever re-entering into the circulation, and, in many respects, acting as a foreign body ; or it may, by a fortunate and fortuitous accident, pass into an adjacent blood-vessel, and continue to circulate, though not in the channel originally intended. According to these circumstances, then, the disease is classed, there being six varieties in which the blood is withdrawn and coagulated—two in which it is permitted to re-enter the circulation ; but, as the lesion which the artery has suffered may also vary as to all or only some of its coats being injured, this circumstance must also be taken into account in any pathological arrangement.

1. When all the three coats of an artery become so weak, and so devoid of elasticity as to yield to the impulse of the circulation at one particular part of its circumference, the spot so impaired becomes gradually distended into a pouch or bag, (termed the sac of the aneurism,) into which blood is poured at each contraction of the heart, some of which remains there and becomes coagulated. The artery, in this case, is dilated, not torn—the sac is composed of its three coats, and the aneurism is termed a *true* one.

2. When, from accident or disease, the two internal coats suffer such a solution of continuity as will permit the blood to pass through them, the impetus of the circulation is then directed against the cellular coat, which

either becomes distended and forms the aneurismal sac :  
or—

3. Is separated to a considerable extent from its attachment to the middle coat. In either of these cases, the two internal coats are torn or ulcerated—the sac consists of the external cellular coat alone—but yet the species have received different names, the former is termed the *circumscribed false* aneurism, (circumscribed to distinguish it from another species to be afterwards described, in which the blood is not contained in any sac :) the latter (3) is called the *dissecting* aneurism, from the fact of the blood separating the external from the middle, in the same manner as might be accomplished by the knife of the anatomist.

4. The true aneurism, consisting of three coats, is much more unyielding than the circumscribed false, it grows more slowly, and seldom attains any very remarkable size : but it is easy to conceive that, having reached a considerable degree of distension, its internal and middle coats may yield to the force of the circulation, or be ruptured by accidental violence, and then a mixed case arises. In this case, the sac at its root, and near to the trunk of the vessel, consists of all the three coats—more remotely, and where most distended, of the external cellular alone. It is properly termed a *mixed* aneurism.

5. When all the coats of the artery have been so injured as to allow the blood to pass freely through them,

and to spread itself through the cellular tissue of the limb, the case is one of *diffused* aneurism. Of this there are different varieties, but it is the condition and situation of the blood that forms the character of the disease and gives the name. Thus an artery may be ruptured by a blow or other violence: the sac of a circumscribed aneurism may be burst; or the artery may be opened in connexion with a small external wound. All these are examples of diffused aneurism, the latter forming a distinct and very important variety which shall be treated of hereafter under the name of *traumatic*.

6. There is a pathological condition of an artery producing all the symptoms of circumscribed false aneurism, and apparently cureable by the same means, which, as yet, has only been noticed and described by myself in the Cyclopædia of Anatomy. It seems to be formed by a dilatation of the fibrous and cellular coats, and the absorption of the internal lining. It appears to be so far a true aneurism as that the artery is uniformly dilated around its entire circumference, and it is so far a false one, that the internal lining membrane has been removed. I know not how to form a name for such a complex aneurism, but will refer to it in its numerical order hereafter.

7. When an artery and its accompanying vein have been opened in such wise as to allow of a free communication between the currents of blood circulating in these vessels respectively: and when such channel of commu-

nication has been fixed and established by inflammation, and the effusion of lymph around, so that the admixture of the currents is constant and permanent, the disease is termed an *aneurismal varix*. In this there is no sac; the blood is not withdrawn from the circulation; it is merely directed into a new and unnatural channel.

8. When such a communication exists between an artery and vein, but with the intervention of an aneurismal tumour placed between them, it has been termed a *varicose aneurism*. This may take place immediately on the infliction of the wound by which the communication is made: in which case the interposed tumour is, and remains, small and inconsiderable. Or it may be produced by the bursting of an aneurism into an adjacent vein: this latter occurrence must be purely accidental, and, of course, is by no means common.

In the consideration of any disease, nothing can be more important than that part of its natural history which treats of the causes of its production, and the pathological changes thereby induced. True, when an aneurism is formed, a knowledge of its exciting cause will give us but little assistance towards its removal; but it may be of great value in determining on the possibility of a cure being effected, and the selection of the means to be adopted with that view; thus if it is occasioned by a wound, the presumption being that the remainder of the arterial system is sound, the probability of recovery will be greater, and the means to be

employed may be milder—such, for instance, will be a fair case for the trial of compression. But if it is idiopathic, a contrary train of reasoning will be legitimate; the presumption is that the artery is diseased, and that the operation, if any thing, may be required. When there are two or more idiopathic aneurisms present, it exhibits such evidence of an unhealthy condition of the whole system as to hold out no reasonable expectation of recovery, and confines us to the employment of palliative measures alone. Thus, then, the history of aneurism is of practical importance, quite independent of the interest that all must feel in a disease so formidable, and, unfortunately, so frequent. But the investigation is attended with great difficulty. Experiments on animals afford no assistance whatever; for, by no contrivance that I am aware of, can an aneurism be produced in one of them: and, as aneurism does not destroy life until it has existed for a considerable time, it is but rarely we meet with a dissection calculated to throw light on the etiology of the disease, or on the early appearances produced by it. There are, however, some facts which bear upon this subject, and are, therefore, worthy of attention.

1. It is a disease unknown to early life, not, (as far as I know,) having been observed antecedent to the age of puberty, and although old age is not absolutely and completely free, it is comparatively rare at that period; from an aggregate of thirty remarkable cases operated on, I find the average to be thirty-three years and a half.



2. It is much more frequently met with in males than in females: this is remarkably proved in cases of internal aneurism, but still more so in the external. I have made the most extensive inquiries on this subject in my power, and can find but one surgeon in Dublin who ever operated for the cure of popliteal aneurism in the female.

3. Arteries are liable to aneurism with a frequency nearly in proportion to their size: thus the most common seat of all is the aorta: and, again, particular parts of these are more liable than others, aneurisms usually having their seats where the arteries are curved or bent, or where a branch may happen to have been given off.

Seeing, then, that aneurism is at least negatively subject to certain laws—that it is not met with in animals—that it is not met with in the human subject before the age of puberty, and rarely in the female at any age—and that it prevails in the larger arteries, we must seek some explanation of its existing cause that will be consistent with these facts. But first it may be necessary to make a few remarks on the causes usually assigned. It is said that certain laborious trades and occupations predispose to aneurism, but this opinion cannot be supported. If it be meant that such persons are more exposed to injury, and that direct violence may sometimes rupture an artery, this is as easily understood as that a person working in the neighbourhood of a steam-engine will be more likely to be entangled therein, and have a limb



torn off, than a person at a distance from it ; but this is only accidental, and by no means a particular liability to disease. I cannot believe that any degree of labour, or exertion, or exposure, predisposes to the occurrence of aneurism ; first, because the most laborious people in society, sailors, blacksmiths, porters, &c., are not a whit more liable to the disease than any other classes in the community : secondly, because women in the lower ranks of life are, in many instances, obliged to undergo more labour, in proportion to their strength, than men—and boys and children infinitely more so ; yet we have seen the exemption that these classes enjoy : and, thirdly, aneurism is not more prevalent among the poor and laborious than among the rich and idle, in proportion to the relative numbers of these classes respectively. This latter assertion is so opposite to the generally received opinion, that many will be inclined to disbelieve it, and its truth cannot be proved for want of statistic reports ; I have made it, however, from my own observation, and would appeal to any practical surgeon of experience for its corroboration. Again, it has been stated that particular trades and callings, chiefly such as oblige their followers to keep their limbs in a bent posture, predispose to aneurism, and this is explained by the idea of the blood being forcibly impelled against the side of the vessel, in consequence of such position. Hence the prevalence of the disease amongst coachmen, postilions, horse-soldiers, &c. But there can be no doubt that other persons are equally, if not more, exposed to such influences, in whom the disease does not prevail—studious

persons, and the higher orders of females, for instance : but with reference to trades, we may recollect that tailors spend most of their time in a very contracted position, and yet no one ever considered them as peculiarly predisposed to aneurism. I cannot, therefore, admit any of these as creating a predisposition to the disease.

If, among a thousand persons pursuing the same avocations, breathing the same atmosphere, and subject to the same general influences, I find nine hundred and ninety-nine healthy, and one only attacked with aneurism ; and if the disease appears in him without his being conscious of having received a blow, or been subject to any violence—if it has appeared so spontaneously that the patient is not aware of the existence of any tumour, until, perhaps, it is remarked by another, it must be conceded that the artery of this one unfortunate individual has undergone some change which will render it more friable—more likely to give way or yield. The points to be arrived at then are—what is the condition of the vessel immediately antecedent to the formation of an aneurism ? and what may be considered the causes that produce this unnatural or morbid condition of the vessel ?

When a large aneurism runs its course with great rapidity, and after death the vessel is found to be in an abnormal and unhealthy state, it is not unreasonable to connect the two affections, and to presume that the diseased condition of the artery led to the formation of the

aneurism. "The vessel in this case, on being slit up, exhibits the internal lining membrane less smooth and polished than in its natural state: its colour is changed to a deep roseate carmine, and it separates from the subjacent fibrous coat with comparative facility. This latter structure is also changed in colour, but not to so bright a red as the other. Between these coats, but more closely attached to the internal, (for they peel off with it,) are numerous specks of a soft steatomatous material, of a white or pale grey colour, presenting, on a superficial inspection, somewhat of the appearance of the calcareous deposit so constantly seen in the arteries of old subjects. An artery in this condition has lost more or less of its elastic properties; it is distended, and its calibre increased equally around. As the arteries are always full, the impulse of every new wave of blood driven on the greater quantity contained within the distended vessel, increases its apparent pulsation; for it is in the diastole, or expanded condition of the artery, that the pulse is felt. This loss of elasticity must obviously weaken the vessel, and cause it to be less resisting—a fact that can be proved by experiment after death, when an artery so circumstanced will be found to yield and tear under a distending force, that would have little effect on it if in health, and will explain how an apparently trifling exertion may produce aneurism in one man, whilst numbers of others exposed to similar or even greater violence escape unharmed."

These appearances have been usually attributed to

inflammation, but without objecting to the term, it will be necessary to bear in mind that inflammation may present itself under two very different—nay, opposite—characters, both as to its pathological appearances, and the effects or results produced. These we may call by the opposing names of acute and chronic, phlegmonous and erysipelatous, healthy or unhealthy. I prefer the latter, because one of them evidently tends to the safety of the individual, the other too often to his destruction.

Thus the early effects of healthy inflammation in arteries are scarcely appreciable by our senses: even with respect to animals, I do not find in Jones' experiments any mention made of the vascular condition of the vessel. In man, it is not easy to obtain an opportunity for satisfying ourselves on this point; but, judging from analogy, it may not be unfair to assume that this species of the affection is ushered in by an increase of vascularity and of redness, followed, however, very speedily by an effusion of organizable coagulating lymph on the surface of the internal membrane, which, if the surfaces are laid together, will in a short space of time so glue and fasten them as to close the vessel permanently at that point. So far, then, a healthy inflammation of an artery terminates by a species of union by the first intention. The unhealthy, we have seen, produces a state of great vascularity in the lining membrane: the colour is very red, but it is seldom uniform, exhibiting here and there patches of great and deep intensity. We have also seen that its qualities of elasticity and contrac-

tility are greatly diminished, and that it will yield and become distended under the ordinary force of the circulation; hence we may understand how some of the pathological conditions of the artery come to be produced. First, the vessel may be rendered distensible throughout its entire circumference, and thence dilated all round, in such a manner as to have acquired the name of *fusiform* dilatation. An artery, however, in this state cannot be considered as aneurismal: the blood circulates through it during life, and no portion of it is coagulated or withdrawn from the system. After death, indeed, a coagulum is always found within it—an additional proof, if such was wanted, that its contractility was impaired and weakened. But one spot of this fusiform dilatation may be weaker than the rest; and if so, it will be likely to yield, become dilated, and a true aneurism thus be formed, in which blood will be arrested and coagulated during life. I by no means intend to assert that true aneurism is always preceded by the fusiform dilatation, because I have seen that which might be considered a fair specimen of the disease spring from an artery unaltered in its natural calibre; but generally, I believe, the fact is otherwise: that an aneurismal dilatation is preceded by a general one more or less of the whole vessel—and both by that condition of the artery which I have designated an unhealthy inflammation.

It has been already stated that an artery thus inflamed is studded over with specks of a soft steatomatous material, and when the disease has proceeded to that



extent, aneurism, if not inevitable, is certainly very likely to occur; for then a different process, and one of which the arterial system is not very susceptible, supervenes. The lining membrane covering one of these spots becomes soft, and soon exhibits a distinct ulcer, which proceeds from within, eroding the middle coat, either through the entire thickness to the cellular, which is then easily distended to the aneurismal sac, or so far that it shall be likely to give way and tear under a trifling shock—even the impulse of the circulation. Preparations illustrative of these different stages of dilatation, softening, and ulceration, are to be found in all our museums: and the following case will explain the formation of aneurism in this manner most satisfactorily.

## CASE.

Edward Lynch, ætat 26, a shoemaker of intemperate habits, was admitted into the Meath Hospital, March, 19, 1833.

Ten days previously he was seized with pain in the back, and stitches in the side and chest, more especially towards the lower part of the sternum, in which latter situation he experienced a dragging sensation also. These symptoms continued without the supervision of any other during a week, when, (on the 16th,) he felt soreness low down in the chest on swallowing solid food, which in-



creased to great difficulty of deglutition on the following day ; and since the 18th he has taken no solid whatever, the attempt to do so always producing great pain and a sense of weight, followed at first by hiccup and then vomiting. Being desired to swallow a morsel of bread, he did so, and said it stopped in the passage. After repeated draughts of whey it passed down, but not without a good deal of spasm, resembling hiccup. It was not vomited.

On examination, the chest sounded well on percussion, and the stethoscope discovered no sign of disease in the heart or aorta. The action of the heart was a little stronger than natural, but the sounds were healthy. Respiration feeble, but pure in the upper part of the right lung.

This case was considered and treated as one of dysphagia—so much so, that on the 21st I passed a probang down the œsophagus. I did not meet any decided obstruction, but was sensible of the instrument passing over a soft tumour. I recollect to have mentioned to several of the pupils the possibility of its being an aneurism, and the awful consequences that must result if the passage of the probang had chanced to rupture it.

On the 27th, in the evening, he had an attack of cough and vomiting, in which he threw up about a pint of florid blood, and died immediately.

## DISSECTION.

The trachea and œsophagus being cut across in the neck, the entire of the thoracic viscera, together with the stomach, were removed from the body, in doing which no tumour of the œsophagus was observed.

The stomach was distended, and of a dark colour: on opening it, a large coagulum of blood was found completely filling it.

On slitting up the œsophagus, a clot, much larger than a pigeon's egg, and covered only by the mucous membrane, was seen projecting into it. Its situation was nearly three inches from the cardiac extremity. The mucous membrane had given way on one spot, and thus was furnished the blood that filled the stomach, and which had been vomited. The pressure of this aneurismal tumour had occasioned ulceration on the surface of the œsophagus opposed to it.

On opening the aorta, the pathology of aneurism, as connected with arteritis, was beautifully illustrated. The lining membrane was of a bright crimson or carmine colour, varied with small spangle-like patches of a paler and more opaque tint. This vascularity resided principally in the lining membrane; for, on stripping off a portion of it, the fibrous tissue, although evidently inflamed, was much paler. The patches above mentioned,

were caused by depositions of a soft white cheesy substance, which were either in the lining membrane or between it and the fibrous coat ; they came off attached to the lining membrane.

There were three aneurisms in different stages of progression. One, the largest, communicated with the clot, which had burst into the œsophagus ; the opening into the aorta would admit the point of the little finger. Another, within about half an inch of the former, was about the size of a hazel nut, its opening into the aorta being about the diameter of a crow-quill ; its internal surface was smooth, as if lined by the inner coat of the vessel ; the middle coat terminated abruptly by a thick cellular edge at the opening, and its external covering seemed to be formed of the cellular coat together with the pleura. The third was only in its commencement ; a slight deviation from the level of the lining membrane was seen in the centre of one of these opaque spots, under which the fibrous coat was thinned and beginning to be absorbed.

The larger tumour had made pressure through the œsophagus, on the right bronchus, at its posterior part, and thus caused the feebleness of respiration observed during life in the right lung.

The lungs were healthy—the heart paler and softer than natural.

Being satisfied that this unhealthy inflammation of an artery is one of the most influential of the exciting causes of aneurism, it would be a most interesting inquiry that could determine the circumstances that lead to its production; and having paid a good deal of attention to the subject, and investigated the history of a great number of cases, I have been led to the conclusion that intemperance, particularly in the abuse of ardent spirits, and repeated or ill conducted courses of mercury have, at least, some intimate connexion with it. This latter medicine is seldom used in great quantities, or for any protracted length of time, unless for the cure of syphilis, and hence many have entertained an opinion that arteritis might be a result of the operation of the venereal poison. In this supposition I find Scarpa, Richerand, Coirvissart, and, to a certain extent, Hodgson, seeming to coincide.\*

Dupuytren, in examining arteritis in connexion with gangrene of the extremities, states that it is found almost always in persons that have indulged too freely in spirituous liquors, in stimulating food, and in those who have suffered from chronic diseases of the heart, or of the aortic valves, or great vessels.†

Bouillaud, amongst the other causes that may produce inflammation generally, enumerates fatiguing and continued exercise, stimulating drinks taken in too great

\* Hodgson on the diseases of arteries and veins, pp. 9—10.

† *Leçons orales*, Tom. 4, p. 483.

a quantity, and the abuse of spirituous liquors as particularly conducing to arteritis.\*

How far these can explain the comparative infrequency of the disease in females, and its prevalence amongst men subject to exposure, and too often of reckless and dissolute habits, must be determined by future observation: but in corroboration of part of the above opinion, it may be remarked that few old persons are subjected to a course of mercury that do not perish shortly after by the bursting of a blood-vessel, of apoplexy, or hæmoptoe most frequently.

In discussing the probable exciting cause of aneurism, I have purposely omitted that alteration of structure which so frequently appears in the arteries of old persons, and which consists in the deposition of an earthy or saline material between their internal and middle coats. Doubtless the presence of this deposit gives an appearance of harshness and friability to the vessel, and there can be no question that it interferes with its elastic properties; but its extraordinary constancy, compared with the infrequency of the disease in subjects advanced in years, at once proves how little efficacy it can have as an exciting cause. In connexion with the morbid anatomy of arteries this deposit may be somewhat interesting; it is found closely adhering to the internal coat from which it can scarcely be separated: it is laid down in specks or spots, extremely thin, and of no

\* Dict. de Med. et Chir. pratiques, Tom. 3, p. 413. .



greater width than a spangle : these spots are not connected one with the other, and never encircle the vessel with an uninterrupted bony ring. The origin and progress of this deposit have never been satisfactorily explained, but it seems to be rather a natural process, somewhat resembling the conversion of fibro-cartilage into bone, observed in certain situations, than a product of, or a predisposing cause to, disease.

An aneurism thus preceded, and apparently produced, by a diseased condition of the vessel, will probably be circumscribed, consisting of the artery, so ulcerated or torn as to allow of the escape of some blood from it at every contraction of the heart, and of a sac formed according to some one or other of the methods already described. From the moment of its formation, the cavity of the sac, like that of the artery, is always full, and hence when it receives the impulse of a fresh wave of blood entering it, it has a tendency to expand equally in every part of its circumference ; but this expansion brings the elasticity of the sac, if it has any remaining, but more particularly of the superincumbent structures, into play, and a proportion of the blood is thus returned back again into circulation. Hence the tumour of a circumscribed aneurism is pulsatile. Now it is evident—

1. That the growth of an aneurism must be rapid or slow, not in proportion to the quantity of blood thrown into the sac, but to that which remains behind, and

hence, in estimating the probable progress of the disease, the situation it occupies must be taken largely into account. The sac of an aneurism, even of a true one, possesses in itself but little elasticity, and a trifling power of resistance; and, although often strengthened by a deposition of lymph, yet it is more indebted to its external coverings, such as fascia, muscles, and skin, than to any thing connected with its own structure. Where there is no such covering—no resistance capable of forcing back the blood into the artery, of course it will remain within the sac, and the growth of such a tumour must be uncontrollably rapid, whilst, where there is such a protecting provision, the contrary effect will be produced, and (*cæteris paribus*) its progress should be proportionally slow. Hence, in determining on an operation, the absolute necessity, not only of estimating the rapidity of increase within the tumour, but of calculating the direction it will most probably take in consequence of a want of resistance—an operation may be feasible to day, which, from an extension of the tumour in a given direction, may be wholly impracticable to-morrow. This proposition I have more than once seen exemplified in axillary or subclavian aneurisms, which, from delay, have been allowed to extend so far upwards as to occupy the spot which should be the seat of operation.

2. Although not to the same extent, the growth of the aneurism must be influenced also by the size of the aperture leading into the sac, for a larger wave of blood will

require a greater resistance to return it than a small one; that is, if there are two aneurisms exactly corresponding in strength of covering and situation, such equality of force must be more efficient in throwing back a small wave of blood than a great one. And as force will have exactly the same operation as quantity, every precaution should be taken to keep the circulation as low and as feeble as can be consistent with safety.

3. Independent of the pulsation which corresponds with that of the general circulation, and will, with it, be excited or depressed, aneurisms do not always beat with the same degree of violence, and, generally speaking, the force of the pulsation is inversely as the age and duration of the disease. It has been already stated that, at each diastole of the artery, a quantity of blood is withdrawn from the circulation, and, in the majority of cases, becomes coagulated, so that the inside of the sac is filled to a greater or less extent with layers of coagula of different colours and consistence, the external or that nearest to the lymph on the surface of the sac being pale, of a yellow or grey colour, and firm in texture like the fibrine of the blood, the internal being dark, red, and of a looser consistence, resembling an ordinary clot. When the sac is full of blood, in a fluid state, the influx of an additional wave will act on every particle and tend to dilate it in every direction, consequently the greater the quantity of fluid blood within it, the greater and the more distinct will be the pulsation: but it has no such effect on a solid, and, therefore, if the sac contains a

large coagulum, its pulsation may be very indistinct indeed. But this does not depend on the age of the tumour invariably, (for I have seen an aneurism of long standing that did not contain a particle of coagulum, and in which the pulsation was awful, even to the moment of its bursting,) but on influences that we cannot always understand or appreciate. I am persuaded there is a difference in different constitutions as to the disposition or tendency of the blood to become coagulated, and, as it may, and, I believe, does, exercise a most important influence on the progress and treatment of the disease, I shall advert to this part of the subject more particularly hereafter.

From these premises it may be easily understood—

Why aneurisms, within the cavities, unrestrained by external pressure, run their course more rapidly than when seated in the limbs.

Why a *true* aneurism seldom attains a large size, but either bursts altogether, or assumes the form of a *mixed* one.

Why aneurisms that have been stationary, or have grown slowly, often proceed with sudden and great rapidity on the receipt of a blow, or other accidental injury, and—

Why it is desirable, by every means, that rest, regi-

men, and medicine can afford, to promote, and if possible, to procure the coagulation of the blood.

## INTERNAL ANEURISM.

Symptoms of Aneurism generally—Terminations—Cerebral Aneurisms—  
Thoracic Aneurisms—Abdominal Aneurisms.

When a person, having experienced a sensation as if something had been torn or given way within the part, or perhaps without any such previous warning, perceives a pulsatory tumour situated on the course of one of the arterial trunks, the probability is that an aneurism has been formed; and this probability will be increased if the pulsation is observed to correspond exactly with that of the heart, or of the pulse at the wrist—if it is increased, as well as the fullness and firmness of the tumour, by exercise, passion, the use of internal stimulants—if it is diminished by rest, abstinence, the application of cold or other sedatives—and if it disappears, on the occurrence of syncope. Pressure on the artery at the cardiac side of an aneurism causes the tumour to collapse, and the pulsation to cease—on the distal side, it renders both these symptoms more remarkable. This pulsation, as it is the great characteristic of aneurism, should be observed with attention: it varies (as before remarked) according to the situation of the tumour and the condition of its contents, and thus other affections may happen to be mistaken for it, and it for them. It



would be cruel to subject a patient to the pain and danger of an operation if the disease was only an enlarged gland, situated on the course of an arterial trunk, and receiving an impulse from it: and it would be a dreadful error to plunge a lancet into an aneurism under the impression of its being an abscess: yet such casualties have occurred; and I have known an aneurism of very long standing to have been regarded as an encysted tumour, and an operation determined on for its removal, which very fortunately was not performed. A mistake on such a point as this could never be pardoned—and, happily, can be easily avoided. A gland or other tumour, receiving an impulse from an artery, is merely lifted up, and the pulsation is only felt at the apex—often by drawing it away from the vessel the pulsation ceases altogether: an abscess receives only an undulatory thrill from an artery, perceptible in the line of the vessel, but fading away and becoming indistinct in the remoter parts of the tumour: but the expansion of an aneurismal sac is equal in every part and every direction, and the pulsation can be felt as correctly at the base or at the side, as at the summit. Occasionally some tumours of a medullary or other fungoid nature exhibit a pulsatile character, and, if they occupy a situation in the course of a large artery, are liable to be mistaken for aneurism—indeed the resemblance is sometimes so great as to render a diagnosis extremely difficult. Nor will the position, growth, or direction of the tumour be sufficient to determine the point in question, for we know that aneurisms are uncertain in these respects, and may present

themselves in very unusual and unexpected situations. I have known a poplital aneurism, for instance, to appear on the front of the leg, beneath the knee, and it was curious that at the same time I had a patient in hospital with a fungoid tumour in exactly the same situation that exhibited a decidedly pulsatile character. These tumours seldom possess such vascular organization as might explain the phenomenon of pulsation: but this is not the place to investigate their pathology, suffice it that they exhibit it to an extent that gives them a striking resemblance to aneurism. I think, in the cases I have seen, the pulsation of a fungoid tumour is less forcible, less distinct, less *prononcée*, (as the French would term it,) than that of aneurism; but I have heard of cases in which the diagnostic symptoms were so obscure as to occasion considerable embarrassment to very acute and sagacious practitioners. Hence the necessity of making the most rigid investigation of every particular connected with a tumour of suspicious nature, for we shall find hereafter that aneurism is a disease, in which even a trifling error may give rise to formidable, if not fatal, consequences. On applying the ear or a stethoscope to an aneurismal tumour, a peculiar sound, termed by the French the *bruit de soufflet*, is often, indeed generally, heard. It conveys the impression as if a rush of air took place into the sac at each pulsation; but as it is impossible to convey any idea of it by description, the practitioner must seek to render himself familiar with it: still, however, it is not pathognomonic, for the fungoid, or

indeed any tumour situated on an artery will produce it, and it may be created by artificial pressure.

The other symptoms are occasioned by the presence of the blood within the part, and the pressure it inflicts on the adjacent organs—a pressure so injurious as always to be troublesome—often the principal subject of the patient's complaints, and occasionally the sole cause of his destruction. As the great arterial trunks are accompanied by veins, the tumour is extremely likely to be so placed as to interfere more or less with the circulation of the blood through them—a circumstance which is first perceived by an increase of size, and a flattening out of the superficial veins, in order to accommodate themselves to the additional quantity of blood forced to circulate through them, and subsequently by the appearance of œdema of the lower portion of the limb, the forerunner of gangrene, if the disease be permitted to proceed much farther. I fear, and indeed I believe, the effects of this pressure are not sufficiently appreciated in estimating the exact condition of a patient, and the probable result of tying an artery. It should always be borne in mind that, however well the vessel is secured, the tumour remains still; and that as its contents become solid, the pressure exercised by it must be greater than before. In order to a cure, this must continue for some days, during which, as the circulation of the limb, deprived of all assistance from the heart, is weak, languid, and slow, congestion will be very likely to take place—

the œdema to be increased, and the whole run rapidly into mortification. It is not at all difficult to conceive that many an operation has been thus unsuccessful, the blame being attributed to a deficient collateral circulation, and a want of nutrition to the limb, when in reality it was loaded and gorged with blood, of which it was unable to free itself.

The physiology of the nervous system is as yet too imperfectly understood to enable us to comprehend all the inconveniences that may arise from pressure on these very important organs. Patients generally complain of a numbness of the limb—of a tingling sensation in the extremities—often of a dull and heavy pain—and sometimes of a weakness and inability to make use of it. Some or other of these symptoms are so constant, that patients frequently make their complaints of them alone, unconscious at the time of the existence of an aneurismal tumour. These phenomena have been usually attributed to pressure on the nervous trunks. But there are other symptoms still, probably referable to the same cause. In every case of axillary aneurism that has come under my personal observation, the fingers of the hand were contracted and crooked, and in one I remarked a rigidity of the wrist-joint. In a case of popliteal aneurism, I have met with a stiffness of the ankle-joint, and constantly the toes are contracted more or less, if the tumour has attained to any considerable size. Whether correct or not in attributing this symptom to pressure on the nerves, I entertain no doubt of the cause

being purely local ; for it is relieved by the operation, and removed with the disease. I have also observed a peculiar kind of itchy eruption on the extremities of aneurismatic limbs, which disappeared after operation ; but there are no data for referring this to any derangement of the nervous influence, particularly where all the fluids must be more or less vitiated, in consequence of the disordered circulation.

When an aneurism is situated in the immediate vicinity of a bone, the corresponding part of the sac is removed, and the bone forms (as it were) a part of the sac, being in actual contact with the blood. The bone then comes to be absorbed, and the surface is rough, irregular, and jagged, as if it had suffered from caries, but differing from this latter disease in that there is no rottenness or offensive odour, nor any secretion of purulent matter or sanies. The old opinion was, that the bone was dissolved and washed away by the increasing current of the blood, and certainly the appearance would countenance such an opinion in the mind of any one ignorant of the existence and activity of the absorbent system. But when cartilage is thus subjected to pressure, it suffers much less than bone, probably from being more sparingly supplied with absorbents ; and it is no uncommon thing, in internal aneurisms, to see large portions of the bodies of vertebræ removed, the intervertebral cartilages remaining comparatively untouched. This absorption or caries of bone is looked upon as a very unhappy complication, and militating greatly



against the success of any operation ; but it must be remarked that there is no situation in which an aneurism likely to be the subject of an operation could be placed, except the popliteal space in which the artery and the bone are in such dangerous juxtaposition ; and if a popliteal aneurism had proceeded to such a length, there would be other and worse combinations than the absorption of the bone.

Although some rare and curious cases of spontaneous cures of aneurism occasionally occur, yet the general tendency of the disease is to the destruction of its victim, and therefore it is in that direction we must pursue its course. Aneurisms terminate fatally in different ways—

1. By the influence of this pressure I have been describing, on some important or vital organ ; for example, instances are by no means unfrequent of persons dying from the compression of a very small aneurism on the windpipe.

2. Where they are bound down by very strong and resisting fasciæ, they increase very slowly ; and thus a patient may die, worn by pain, irritation, and that irregular hectic, which always attends diseases accompanied by hæmorrhage. Such patients generally, for two or three days previous to dissolution, exhale from their bodies a peculiarly offensive cadaveric odour : and I have seen

them surrounded by flies, just like a dead body in a dissecting room. But,

3. The most frequent termination is by the bursting of the sac. As the disease proceeds, the tumour increases in size, and approaches the surface: the cellular tissue is absorbed, and the coverings become daily thinner: at last a slough forms in the skin, and on its separation the blood breaks forth.

It is awful to witness the bursting of an aneurism. Sometimes death is instantaneous, and seems to be the consequence of a single gush: but more frequently, as the detachment of the slough is slow, it separates first at the edge, and the blood oozes out, and a considerable quantity may be lost; but then in general the coagulum is forced into the aperture, and restrains the bleeding—or, perhaps, if the patient faints, controls it altogether for the time. Yet is the calm only for a few hours: the blood breaks out again and again: the patient sinks, becomes exsanguine and exhausted, and dies miserably in the course of three or four days.

Aneurisms are practically divided into the external and the internal; the external being such as, occupying some situation on a limb, are susceptible of cure by surgical operation; the internal being so placed as to preclude the possibility of such relief—that is, being within one of the great cavities, the head, thorax, or abdomen.

In any of these localities, the disease may occasionally exist, without affording satisfactory sensible evidence of its presence, and therefore, in cases of internal aneurism, the symptoms (at least those which are most obvious and most distressing) are of the class produced by the pressure of the sac on some of the adjacent organs. Of course, as the structure and functions of the viscera are different, and are not all of equal importance to life, not only will the symptoms of each internal aneurism be different, but their duration and intensity must be extremely variable; and therefore are these cases interesting, not only from their unmanageable nature and formidable results, but from the great risk incurred of their being mistaken for other affections.

Aneurisms within the brain are, and must be, extremely rare; for the arteries here are comparatively small, and we know that these structures possess what Hunter would call "a disposition" to disease directly in proportion to their size. Neither do I think that the frequency of apoplectic effusions at all militates against this opinion; for in most instances the vessel or vessels from which the blood proceeded cannot be detected, and there is more reason for considering it to be the product of venous than of arterial hæmorrhage. No doubt, when an artery bursts within the brain, the blood cannot be contained within a sac, because the vessels in this situation do not possess a cellular coat, by which it could be formed; and, therefore, under such circumstances, it must be apoplexy—it cannot be a case of circumscribed

false aneurism. But, however infrequent, I consider the occurrence of a *true aneurism* within the skull to be possible. Several years ago, I had an opportunity of seeing an aneurism, about the size of a small bean, in the basilar artery, the coats of which contained the same kind of earthy deposition that pervaded all the other arteries in the body, and which, therefore, must have been formed by dilatation only. The subject had been a man of some consequence, who suffered greatly from, and eventually died of, urinary disease. During life he exhibited some derangement of the cerebral functions, which was attributed to sympathy with the bladder—he became absent, totally forgetful, listless, sleepy, and almost comatose; finally he died, and this little aneurism was found, the rest of the contents of the skull being perfectly normal and healthy.

Thoracic aneurism is unfortunately of great frequency, the aorta being the seat of the disease as often as all the other arteries in the body taken together, and they are extremely likely to be overlooked or mistaken for other affections, for reasons which will at once occur to any one reflecting on the anatomical construction of this cavity, and the number and functions of the organs it encloses. The aorta (except immediately near the spine) is placed at such a distance from its bony cage, that an aneurism must either be very favourably placed, or have attained a large size, in order to its pulsation being perceptible from without—if it exists low down on the descending portion of the vessel, such an occurrence is not

to be expected at all: if it arises from the arch, and in process of time makes its appearance above the clavicle or the sternum, it may then be mistaken for aneurism of the innominata or subclavian. But the stethoscope, which lays bare to our observation every other affection of the chest, does it not also come to our assistance here, and announce the existence of such an important lesion? Assuredly it does in many, perhaps in the majority of instances, but not in all. There cannot be a doubt that many cases have occurred, in which "the stethoscope discovered no sign of disease in the heart or aorta," nor can this be attributed to careless examination, or want of competence in the auscultator; for no later than the past winter, a specimen of aortic aneurism was *exhibited*, which, during life, had been mistaken by more than one, and treated as pulmonary consumption. But in stating this as confirmatory of the difficulty which occasionally surrounds these cases, let me not be mistaken as at all depreciating the value of this useful instrument. I was one of the first surgeons who publicly acknowledged its utility, when employed many years since by Doctors Graves and Stokes in the Meath Hospital, and have since inculcated on every student the necessity of a most attentive practical study of it. No! If there is difficulty, let it only stimulate our exertions farther. Comparatively a few years ago, we knew nothing of a bruit or a rale, and those operations of disease which are now exposed to our organs of sense were wrapt in mystery. What encouragement is it to persevere, when we reflect on what a few years more may accomplish!



In consequence of the thoracic aorta not being bound down by strong and resisting fascia, the growth of an aneurism ought to be rapid, and its pulsatile phenomena less distinct, as compared with similar tumours situated elsewhere; and there is another valid explanation of the rapid progress of this disease, in the mobility and in the compressible nature of the organs contained within this cavity. The lung can offer no mechanical resistance to the growth of a tumour in any direction, and even the heart can be displaced so as to exhibit its pulsation at the right side. Hence we can easily understand how an aneurism shall appear to have come to its fatal termination within a few weeks, or even a few days, after its symptoms had been first observed. But the contrary has been often observed, and many cases are on record in which, notwithstanding the general ambiguity of the symptoms, there was reason to believe the disease had existed for years. Besides the circumstances already mentioned as exercising an influence on the growth and progress of aneurisms generally, it may be important to remark that aneurisms of the thoracic aorta are, in their commencement, almost always *true ones*, formed by dilatation, and consisting of all the true coats of the artery: these commence insidiously, increase slowly, and never attain any very large size. I have, in my possession, some preparations illustrative of the commencement of the disease—particularly one taken from a subject that had died of pleuritis; it shews a small thimble-like cavity, about the size of half a filbert evidently composed of the three coats, and its existence had never been

discovered during life. I have never seen a true aneurism larger than a small orange, and believe that after it reaches that size it either bursts altogether or becomes a *mixed* one. Mixed aneurisms, within the chest, must increase with great rapidity: and hence, in cases that have seemed to be of long duration, the symptoms, whatever they may be, are indistinct and unsatisfactory at first, but, towards the latter end, are equally severe and well marked.

In cases of thoracic aneurism, there is generally some irregular action of the heart—irregular is the only word that can be used; for, in this respect, there are almost endless varieties—sometimes it is wonderfully increased—there are palpitations, faintings, and other symptoms usually considered as indicative of the existence of organic disease in this viscus: sometimes the heart's action is regular on ordinary occasions, but becomes strongly excited by walking up stairs, or any similar exertion: sometimes there is absolute intermission; but a very frequent, and, I think, characteristic symptom is a want of accordance between the heart and the arteries in one or the other of the superior extremities, the heart beating violently, whilst the pulse in one arm may be scarcely perceptible. When the aneurism is seated on the arch, the stethoscope may be of very great assistance—when on the descending it is of very little—when very low down it is of none. Occasionally, a distinct double pulsation, as of the contraction of two cavities, is heard

towards the superior part of the thorax—at the junction of the second or third rib with the sternum on the right side—or corresponding to the junction of the first and second pieces of the breast bone. Often, a *bruit de soufflet*, or a *bruit de rape*, may be heard at or near to the same situations ; and, very frequently, the veins of the neck, or of one side of it, are swollen and distended.

All the other symptoms of thoracic aneurism have reference to the degree and direction of the *pressure* exercised on one or other of the organs within the chest. Few tumors could exist in the neighbourhood of the arch of the aorta without compressing the trachea or bronchial tubes more or less, and hence there may be difficult or imperfect respiration of every possible character and intensity, from a slight feebleness to a total absence in some part or portion of the lung. There is also dullness of sound in the seat of the tumour, and of the parts of the lung deprived of air. There may be also cough, harsh, dry, without expectoration, and occurring in fits and paroxysms : and when such symptoms are present, it can be easily understood how these cases have been mistaken, and treated for every possible form of pulmonary disease. But one of the most curious results of thoracic aneurism is where it simulates acute laryngitis, in consequence (as supposed) of some pressure exercised by the tumour on the recurrent nerve. I have, on another occasion, noticed the possibility of such an occurrence, but the following case is a still more remarkable example:—

In July, 1837, I was requested by a professional friend to see a patient of his suffering from laryngitis, and, if I deemed it necessary, perform the operation of bronchotomy at once. It had been only of three days' standing: the symptoms were dreadfully urgent and pressing—so much so, that I thought I had never met a more formidable case; and the idea of an aneurism never crossed my mind, as he had been attended by two physicians, one of them a most accomplished stethoscopist. I proceeded to operate without delay, and some notion may be formed of the urgency of the case when I state that I punctured the trachea with a trochar, rather than wait a few minutes for the purpose of controlling some hæmorrhage that was present. After the operation, which afforded immediate relief, the patient was removed to the Meath Hospital, where he died, suddenly, in three days afterwards.

The case had been one of aneurism of the superior part of the descending aorta, which terminated by bursting into the left pleura; and, as the difficulty of breathing had been relieved by the operation, I imagined it at the time to have been produced by spasm of the glottis, occasioned by pressure on the recurrent nerve. \*But I have since seen so many instances of spasm of this organ being produced by remote influences, and occurring under circumstances apparently so little in connexion with it, that I am unwilling to refer it to this, or indeed any particular cause, except remote sympathy—an expression

\* See Cyclopædia of Anat. and Physiol. vol. 2, p. 124.

which will cloak ignorance under an appearance of science as well as any other.

I have already stated a case which furnished many of the symptoms of stricture of the œsophagus.

As to the great characteristic of disease, "pain," I know not how to speak determinedly of it with respect to thoracic aneurism. I believe the arterial structures generally not to be endowed with very acute sensibility, and probably great and important organic changes may take place in them without causing much distress. I never knew a small aneurism not pressing upon any important tissue to be accompanied with any remarkable suffering, and instances are sufficiently familiar of patients having dropped dead in whom the existence of the disease had never been suspected, in consequence of their never having uttered a complaint. But it is very different when the tumour has attained a larger size, for then severe and lancinating pains are experienced, not only in the chest, but in parts very distant from it: thus patients complain of spasms, and stitches in the side—of acute soreness in the spine of the scapula—severe and constant head-ache, resembling hemicrania—and one of the most prominent symptoms is cramps in the muscles of the extremities, attended, occasionally, with great debility, amounting almost to a paralytic loss of power and motion.

It may be easily believed that, as the progress of the



disease is variable, so may be its terminations, and it really destroys its victims in different ways. I have already shewn that a patient may be strangled by spasm of the glottis, and he may also be suffocated by the mechanical pressure of the tumour on the trachea or the other air tubes : but the most frequent termination is by bursting. Sometimes it opens into the œsophagus, and the blood is partly vomited, partly thrown into the stomach—sometimes into the trachea, where the blood instantly suffocates the patient—sometimes into the cavity of the pleura or pericardium—more rarely it makes its appearance above the sternum, or the clavicle, or more directly in front, by causing the absorption of the sternum or ribs, and bursts externally.

Very rarely the thoracic aneurism, having caused an extensive absorption of the bodies of the vertebræ, appears as a tumour pulsating frightfully between the scapulæ, or lower down in the back : but it is quite impossible to enumerate all the positions which the disease may occupy, or to calculate the direction that any one may take. Not long since, a man was admitted into the Meath Hospital, suffering from pains in the chest, and most of the rational symptoms of thoracic aneurism—these suddenly subsided, and were shortly followed by the appearance of a soft tumour in the left groin, not distinctly pulsatile, but evidently exhibiting a weak thrill. He died in three days, and on examination, an aneurism of the thoracic aorta was found—its sac had made its way downwards between the crura of the dia-

phragm, and had burst behind the peritoneum : the blood was then apparently conducted down along the psoas muscle and presented at the groin.

Aneurisms within the abdomen must be practically divided into those of the aorta itself and those of its branches. It has been remarked that aneurism is not met with, except in the larger arteries ; all below the third order of branches being exempt, and the disease not appearing externally in any vessel of a smaller diameter than the radial. It was also stated by Hunter, that the strength of the muscular coat of an artery was inversely as its calibre, and became stronger as it was remote from the heart ; and by those who deny the muscularity of arteries, it still must be conceded that the fibrous coat of a small artery is comparatively stronger than that of a larger trunk. These propositions being generally true, abdominal aneurisms are by far most frequent at the aorta, but they are occasionally met with in some of the branches also ; and, although this might naturally be expected from their size, yet there seems also something connected with their structure predisposing to the disease, for they are found often to be ruptured in the common anatomical operation of injecting the vessels with wax. Aneurisms of the splenic, the hepatic, the spermatic, the coronary arteries, and their branches have been all observed, and, during life, have been all mistaken for diseases of the several viscera compressed or displaced by the growth of the tumour. They, in many respects, bear a strong pathological

similitude to aneurisms within the thorax. Placed among soft and compressible viscera, they have room to increase rapidly, and in any direction ; as the organs are mostly loose and floating, they are easily displaced ; as the aneurism is never bound down by any tense or resisting fascia, its pulsation is very indistinct—is lost amongst the hollow viscera—and is scarcely, if at all, to be distinguished from the common phenomena termed epigastric pulsation. If the aneurism is deeply seated, and has displaced any large and solid viscus, the pulsation may not be perceived, and the pains and the other symptoms will naturally be attributed to any rather than the real cause. From these considerations it may be easily understood why these diseases are seldom recognised during life—how their progress may be very rapid—and their end sudden—they almost always terminate by the bursting of the tumour.

The affection, when it exists in the abdominal aorta itself is, however, not often overlooked, for the sac, bound down by strong and unyielding fascia, exhibits the phenomena of pulsation, and the other symptoms with a too faithful accuracy ; and, moreover, although the aneurism of one of the smaller vessels may, as we have seen, have room to increase amongst the unresisting viscera, without occasioning much pressure, and, of course, without much pain—that of the aorta surrounded by important nerves—accompanied by the vena cava—and in juxta-position with numerous organs of the greatest consequence, cannot do so, and therefore, these

affections are invariably attended with great suffering—sometimes by pains resembling inflammatory colic—sometimes neuralgic, and, therefore, anomalous—but always of an extremely aggravated character.

As far as I can form an opinion from my own observation, I know of no disease more painful than aneurism of the abdominal aorta—an opinion borne out by the fact, that many so afflicted die, worn out and exhausted before the bursting of the sac. But, as in all cases of internal aneurism, there may be a great variety in these symptoms—for instance, according to the state of distension or otherwise of the viscera, the pulsation may be plain and distinct, or it may be obscure; and if the aneurismal aperture in the artery lies directly on the face of the vertebræ, there may be no pulsation perceptible at all. For these pathological reasons it will be easily conceived that the affection may be extremely slow in its progress, and that patients tortured with pain and suffering, with colic and indigestion, with cold, œdematous, and swollen extremities, may have gone about from place to place, and from practitioner to practitioner, treated for every disease but the one present, mistaken and mismanaged by all, until death released them and revealed the nature of the affection—an example of the obscurity that overhangs medical diagnosis and of the uncertainty that must prevail in the management of disease.

But although it may be difficult to ascertain the

pulsatile character of the disease, may we not here avail ourselves of auscultation, and seek for some corroboration of our suspicions from the "bruit de soufflet?" Undoubtedly; for though not a certain or infallible sign of the existence of aneurism, yet, taken with others, it is a valuable adjuvant. But although from the construction of its walls, the cavity of the abdomen appears to be a more favourable locality than the thorax for this kind of exploration, it cannot be denied that the symptom is often indistinct and unsatisfactory, and is sometimes altogether absent. \*There is an explanation of this fact offered by Dr. Corrigan, which I think extremely ingenious, although I cannot coincide entirely with it. He says, "if an aneurism be in a constant state of distention, equally as the arterial trunk with which it is connected, then there can be no gush of a diverging current of blood into it; there can be no vibration of its parietes, and there will of course, be no bruit de soufflet." An aneurism of the abdominal aorta is peculiarly calculated for preventing the production of the sound in this manner, and the doctor proposes to remedy the defect by altering the patient's position. "It occurred to me," says he, "that if I could relieve an aneurism of the abdominal aorta from this hydrostatic pressure, that keeps it constantly distended, thus preventing that gushing current into it which produces bruit de soufflet, this sign might become perceptible, and we should then be able by its presence to diagnose aneurism of the aorta at a much earlier period than we have yet been

\* Dublin Journal of Medical Science, v. 2, p. 378.



able to achieve." He places the patient then in a recumbent position, whilst employing the instrument. The obvious objection to this explanation is, that it supposes an aneurism to be in a constant state of distention, which it never can be as long as it contains fluid blood, and its sac is capable of yielding to the force of the heart's action: if it could be, the blood thus left in a state of repose would soon coagulate, and spontaneous recoveries be much more frequent and numerous than they are. The objection, however, is only theoretic, and with respect to the practical fact, I am quite aware that a bruit de soufflet may be heard in one position, whilst in another, it may not. The observation is a correct one, although the explanation may not be entirely satisfactory.

## TREATMENT OF ANEURISM.

Treatment of Aneurism—Natural Recoveries—Indications and Prognostics derived from them—Valsalva's Treatment—Suggestion of Dupuytren—Constitutional Treatment—Local Treatment—Cases not to be interfered with—Cases for Amputation—Treatment by Compression.

Having considered the pathology and symptoms of aneurism, we proceed to a still more interesting part of our inquiry—that of the management of so formidable a disease, and, in the prosecution of this, we ought to derive no little encouragement from observing the occasional spontaneous recoveries that occur. True, these recoveries are not always the results of processes analogous to those produced by our operations, and sometimes

are such as we can neither understand or explain, yet may they prove extremely useful in exhibiting the resources of unassisted nature, and inciting us to perseverance and to hope under circumstances the most unpromising. It is said that an aneurism, then, may thus be cured in one of three different ways :—

1. By inflammation attacking the sac, thence spreading to the artery, and producing within it an effusion of lymph, and its consequent obliteration ; but if it be recollected that the structure of an artery is such that it does not readily participate in any surrounding inflammation ; and even if it did, that the inflammation of the sac would be much more likely to run into suppuration than to promote adhesion, it will be readily believed that this occurrence must be very infrequent. Amongst a number of cases of spontaneous recovery, I have never met with one that could be referred even to a distant or partial operation of this cause.

2. By gangrene of the sac involving the artery and blocking it up, just as mortification does elsewhere. This is also infrequent, (although there are some well-authenticated cases on record,) and must be extremely perilous ; for, if the artery does not inflame while the sac and its coverings are sloughing, the consequence will be that the patient dies of hæmorrhage.

Lastly. It may be accomplished by the growth of the tumour, in such a direction as that a part of it shall

come to press upon the artery above the aperture into the sac, and thereby perform the same office that a ligature placed on the same spot would be calculated to effect.

Such are the processes to which spontaneous recoveries have been generally attributed ; and yet, in the majority of cases, we seldom see one of them exemplified—the disease sometimes gradually subsides—sometimes suddenly disappears without our being able to explain the fact—and dissection has not hitherto satisfactorily developed the resources of nature in this particular.

I am aware of a case in which an aneurism had proceeded so far as to have caused absorption of the sternum: the tumour pulsated externally with a violence that threatened its bursting almost momentarily ; the patient lay on his bed, propped up with pillows, expecting nothing but the most miserable death ; yet, without any obvious cause, and in despite of the prognostics of his attendants, the pulsation suddenly stopped, the tumour subsided, and he is not only alive but strong and active at this moment.

A very interesting case occurred not long since at Stevens' Hospital: a man had an aneurismal tumour over the left clavicle, generally supposed to have been connected with the subclavian artery: various consultations were held upon the case, and operation was determined on when it was observed that the force of pulsation

had somewhat diminished. I know not but that gentle compression might have been attempted, but the position of the tumour was so unfavourable that such treatment could have had no very decided influence on the disease; nevertheless, from day to day, the violence of the pulsation subsided—the size of the tumour diminished—and he left the hospital well.

I have seen one remarkable case of recovery which I scarcely know whether to designate as spontaneous or otherwise: it affords but little practical information, but is, nevertheless, too curious not to attract attention. In the month of December, 1831, I attempted to pass a ligature round the innominate for the cure of a very large subclavian aneurism, but failed, in consequence of the vessel being extensively diseased. The history of the case, and the steps of the operation, have been already detailed in the first number of the *Dublin Journal of Medical Science*, March, 1832, and therefore need not be repeated here: it is, however, interesting to state that the patient recovered perfectly. The aneurismal tumour disappeared entirely—the man's health and strength were so completely restored, that he was able to return to his former occupation, as a day-labourer in the country, and, I believe, he is alive and well at the moment in which I write. It is not reasonable to conjecture that the mere exposure of so large a vessel could have led to its obliteration.

To return, however, to the surgical treatment of

aneurism, we must recollect that it is a case of hæmorrhage, with the sole peculiarity that the blood which is withdrawn from the bleeding vessel still remains within the part or organ: the indication, therefore, to be fulfilled resolves itself into two parts—one, the arrest of hæmorrhage—the other, the removal of the effused blood. Now, it has been already seen that the first or immediate means by which hæmorrhage is controlled, is by the application of pressure on the bleeding vessel—the second, or remote, the establishment of such a degree of healthy inflammation within it as will lead to its permanent obliteration. Such are the principles which guide us in all our treatment, both medical and operative. When we succeed in fulfilling them the disease is cured—when we fail, that is, when we either cannot apply pressure, or that our pressure does not excite the requisite degree of inflammation, our practice is insufficient, and the disease proceeds. Again, as in the case of hæmorrhage, we avail ourselves of the coagulation of the effused blood, in order to effect the pressure by means of the clot—to this all our prescriptions, all our practice tend: but it cannot always be accomplished, for sometimes we cannot procure coagulation, and sometimes, although the clot is formed, it will not effect the requisite degree of pressure. Hence we can deduce some prognostics as to the probable termination of any given case of aneurism.

The aneurism which pulsates violently, and is increasing with great rapidity, is extremely unpromising, for in such there is a large aperture leading from the artery



into the sac, and a large wave of blood, at every pulsation, disturbing that which had been previously effused, and preventing its coagulation.

Aneurisms which are very soft, and in which the contents of the sac are entirely, or nearly, fluid, are not likely to be benefitted by any treatment. There are some idiosyncrasies in which the blood scarcely seems to have any tendency to become coagulated at all, and I have seen large aneurisms, the sacs of which did not contain the smallest portion of a coagulum.

An aneurism, seated amongst soft and unresisting structures, is not one from which very favourable results may be anticipated: for even if the blood becomes coagulated, there may not be a sufficient force to press the clot against the bleeding vessel. This may obviously occur to aneurisms within the thorax, and I will have occasion to shew a very interesting example of this cause of failure in an aneurism placed more externally.

As internal aneurisms cannot be made the subjects of surgical operation, their treatment must be purely constitutional, and will consist of two indications:—

1. As a state of rest is found to be most conducive to the coagulation of the blood, every thing will be of use that can contribute to diminish the size of the wave of blood driven into the sac, and the force with which it is impelled; and—

2. We should resort to any measures which we may have reason to imagine would increase the tendency of the blood to become coagulated. On these principles, then, we endeavour to avoid every excitement both of body and mind, (and I believe the latter to be the more important,) we enjoin the most perfect rest—and abstinence pushed to the utmost extent that can be endured.

Such was Valsalva's celebrated plan, as handed down to us by Albertini one of his contemporaries. It consisted of repeated bleedings—rest—almost absolute starvation—and the topical application of cold. He allowed his patient but half a pound of bouillè in the morning, and half that quantity at night—water for his drink, and even that but sparingly, and medicated with some substance of a refrigerating nature. In this way he brought down his strength, until he was barely able to raise his hand from his bed, when some little additional nutriment was permitted, in order to save him from perishing, but on the slightest recovery he was again reduced: and, he says, he cured a patient thus, and, what is of more importance, Sabatier stated that he saw a case of subclavian aneurism thus treated with success; and the cases published by Pelletan appear to furnish evidence that vast aneurisms of the aorta, so large as to project through the absorbed part of the ribs and sternum, may sometimes be cured by this process. Still these cases are too few in number to establish the point satisfactorily, and it must be recollected that the most extraordinary and unexpected recoveries occasionally

occur without any treatment whatever ; moreover, few persons will be found capable of enduring such suffering with sufficient perseverance, for, as a patient of mine quaintly expressed himself, it is really endeavouring to preserve life by making life not worth preserving.

Many practitioners object, at least, to the theory on which this practice is founded, as being calculated to aggravate rather than assuage the evil. It will not be enough to diminish the force with which the blood is driven into the sac, if the tendency of the same blood to become coagulated is diminished in the same proportion, and they assert that "Valsalva's plan" disposes to this latter effect by rendering the blood too fluid, too watery, and depriving it of its proper quantity of fibrine. My friend and colleague, Dr. Stokes, acted on this hypothesis, (first suggested, I believe, by Dupuytren,) and adopted a line of practice which he considered would diminish the quantity of the circulating blood, and, at the same time, increase that of the fibrine within it. He recommended small and repeated bleedings, but a diet the opposite to Valsalva's: it should be light and very nutritive, but, of course, free from any material of a stimulating nature. He quoted several cases in illustration of the value of this treatment, which had been confirmed by himself in the Meath Hospital ; but I have not yet had sufficient personal experience to enable me to advance any very decided opinion on the subject. It is one of immense difficulty. From observation on different cases of aneurism, I have been led to believe that

there is a greater tendency to coagulation in the blood of one person than of another—in short, that there is a variety of disposition in this respect; but of the external marks, characters, or symptoms by which the presence or absence of such tendency can be recognised, I am wholly ignorant. At present I know of but one circumstance which certainly disposes the blood to coagulate—namely the abstraction of a great quantity of that fluid from the system, and, therefore, if I attempted a cure on this principle, I would employ large bleedings—so large that each of them should produce syncope or some other decided impression on the entire circulation: it is, however, but fair to state, that having made several trials of the plan, I cannot speak favorably of it as a means of permanent cure, although in other respects I may think highly of it. Unfortunately we do not often meet with internal aneurisms in their incipient or early stages, when we might more reasonably expect advantage from some decisive treatment—in such I have had no opportunity of making the experiment: but even in cases of long standing and large size, in which a cure might almost be regarded as impossible, I can speak of the efficacy of large bleedings, in affording temporary relief, with all the confidence derived from experience. In one remarkable instance, I had a patient with aortic aneurism bled to syncope several times, even to the extent of forty ounces of blood, and always with the obvious result of relieving the pain and difficulty of breathing, and enabling him to lie in any position, which, at the time of his admission, had been impracticable. At the moment

in which I write there is a patient in the Meath Hospital with an abdominal aneurism, of immense size and fearful strength of pulsation, that has been treated in the same manner with such marked relief from suffering that he has frequently solicited to have the operation repeated. An apprehension has been entertained by some that a patient thus suddenly reduced to a state of syncope might never rally, and actually die of, or be killed by, the operation; and, perhaps, such a casualty may have occurred, but nothing even approaching to it has ever happened within my observation.

Some suggestions have recently been offered as to the possibility of causing the blood within an aneurismal sac to become coagulated by means of certain chemical agents, and some experiments have been made of an apparently satisfactory nature, it being perfectly obvious that if such coagulation can be accomplished, the cure of the disease ought to follow. Thus, heat, electricity, galvanism, and the injection of certain fluids which have, or are supposed to have, the power of promoting the coagulation, have been spoken of as offering some chance of effecting a cure on this principle. But in considering these, or similar proposals, it must be recollected that blood circulating within a living body, and blood withdrawn from it, are very differently circumstanced—that the one participates in the vitality of the general system, one of the essential qualities of which is the resistance it offers to the laws of chemical affinity, whilst the other, from the moment it is withdrawn, if not dead, is rapidly



parting with all that distinguished it from inert and inanimate matter. It is more than doubtful therefore whether any conclusion can be drawn as to the probable effect of any agent on blood still circulating in the system, from observations made on a similar fluid in a basin or a cup. But there is another point of view in which this subject should be considered. I have performed numerous experiments of this description myself with the view of ascertaining the relative powers of different substances in producing a rapid and solid coagulation of fresh drawn blood, and never were experiments more completely devoid of any profitable result. Wherever the blood became rapidly *solidified*, the appearance, and (I suppose) the nature of the mass were changed, and a new substance formed in no way resembling a natural coagulum: the result seemed to be purely chemical, and subject to the laws that govern such operations in dead and inert substances. I have already stated that similar effects would probably not be produced on blood within the system, and even if they were, I feel convinced that the presence of this new material might prove highly irritating and injurious.

This is but a speculation, and I suspect it will be long before its value will be tested by experiment. No one can tell the quantity of coagulum within a sac, or how far a needle or an injection can be pushed before it would reach the fluid blood. Few will try it with an external aneurism that can be so much more easily and certainly dealt with by operation, with the risk before their eyes

of producing inflammation, suppuration, and even gangrene of the sac; and still fewer with an internal one near the heart without knowing the effect such injected material would produce on that organ, if it reached it, or on the general circulation. Still the disease is of such a dreadful nature, and its result so fatal, that no chance should be rejected of discovering some means of arresting its progress, and, perhaps, by unwearied diligence and repeated trials, we may yet arrive at some means of mitigating so serious an evil.

In connexion with these local remedies, the internal exhibition of such medicines as are known to diminish the force and frequency of the heart's action ought never to be omitted. Thus I have seen the very best effects from the administration of digitalis in such doses as evidently rendered the pulse slower; and preparations of antimony have also been frequently employed with a similar result. Great caution, however, should be observed in the management of these medicines. Digitalis is one of those poisons, the powers of which lie dormant for a time, and then assail the patient with accumulated violence; and antimonials, if they induce nausea, debility, and sickness, may be generally very beneficial, but pushed beyond that, they must be injurious, and may be destructive. There is usually a state of re-action produced after vomiting which is exactly the opposite to that which is sought for; and besides, it would be an awful catastrophe to witness in the strainings and retchings accompanying the discharge of the stomach, the

sudden rupture of the sac, and the instant death of the patient. In a word, the treatment may be very shortly summed up—rest, abstinence, quietude of mind, debilitating medicines, and the topical application of cold—this latter I have always found to be of the greatest use. But, after all, there is nothing cheering in the management of these cases: they may be retarded in their progress, but still the fatal termination is but too inevitable; and if in the chapter of accidents, some solitary case of recovery should fall out, in the present state of our knowledge, it must be regarded as one of nature's efforts. Medicine and medical treatment can claim but little share in the occurrence.

But not so with the external forms of the disease: they are within the reach of operative surgery, and if there is any one thing more than another to raise this branch of the healing art to the eminent station in public opinion it ought to possess; and, moreover, any one in which the labours of British surgeons have been rewarded with a more than ordinary degree of success, it is this one. It is not very long since an attack of aneurism was nearly equivalent to the patient's death warrant—with this difference, that death, always sufficiently dreadful in apprehension, was rendered tenfold more terrible in reality by the mangling and mutilating operations to which the poor sufferer was previously subjected. But a few years have elapsed since the treatment of the disease was so indifferently and so imperfectly understood, that if all the afflicted did not die, certainly but

few recovered, and there is small reason for attributing this wretched and partial success to art, as no less an authority than Pott averred that there was no hope but in mutilation. Yet even was that hope scanty and deficient, for, as Hunter remarked, and according to the observation of every surgeon since his day, amputations are less successful in cases of aneurism than of any other disease whatever. To the sagacity and penetration of Hunter, the profession stands indebted for the first marked improvement in the management of this disease, and this commencement, so happily made, has been followed up by his countrymen with such industry, ability, and enterprise, as to have stripped the malady of more than half its terrors. We now propose an operation with confidence, and we generally perform it with success. I say "generally," because in this, as in every other part of surgery, care and discrimination are necessary, and an operation should be no more performed where recovery is impossible, than it should be declined or delayed where it holds out a hope. I shall, therefore, consider aneurism with reference to the cases in which all interference should be avoided—those in which it may be necessary to resort to amputation—and those in which recovery is practicable without such mutilation.

1. It is barely possible to point out a case of aneurism in a limb that would justify a surgeon in refusing to interfere, and thus condemning an unfortunate being to linger out the remnant of existence in bodily suffering and mental agony: yet, perhaps, there are occasionally

a few of such cases, for patients should not be subjected to useless pain, and valuable surgical operations ought not to be brought into disrepute, by being performed when there are obvious and forcible reasons to anticipate a failure. In persons who labour under a generally-diseased condition of the circulating system, there is scarcely a possibility of an operation proving fortunate, and the surgeon should decline all interference when there is satisfactory evidence of the existence of such an objection.

\*CASE.

E. K., aged 34, of delicate appearance, admitted into Mercer's Hospital, 24th November, 1838, under the care of Mr. Tagert. He had been a rough-rider in a lancer regiment, and latterly in the police force.

He presented himself with a popliteal aneurism in the left limb, the local symptoms of which it is unnecessary here to detail ; but, on examination of the chest, there was violent action of the heart perceived, this viscus beating against the ribs with much force—dulness over the part corresponding to the left ventricle, which, on percussion, appeared to be increased in size—a bruit de soufflet heard over this region, but not so distinct as in the tumour—a *peculiar jerking or bounding of all the large arteries*—the sound also extended into them—lungs appeared healthy—had no cough—much dyspnœa on

\* Dublin Medical Press, v. 1, p. 180.



exercise—perspirations at night—pulse about 100—appetite good—bowels natural. He has had palpitations of the heart about twelve months—sometimes feels oppression of the chest—this has on occasions amounted to agony upon taking very active exercise, compelling him to stop from apprehension of losing life—has, for some months, been subject to epistaxis, and has latterly lost flesh.

Mr. Tagert, under these circumstances, determined not to operate, in which opinion (he having done me the favour of consulting me,) I cordially agreed, and no material change occurred until the night of the 5th of December, when the patient felt something burst in his ham, after which he suffered great pain. The aneurism had become diffused, and nothing now remained but amputation, to which he refused to submit.

He continued to suffer much pain for a few days, and on the 12th of December, at the morning visit, he was found in great agony; a second rush of blood had taken place the previous night. The calf, and entire of the back of the leg was enlarged, tense, and swollen, almost to bursting—it was hard and shining, presenting, in many parts, a dark and mottled appearance—the heat of the limb was diminished, and no pulsation could now be felt in the anterior tibial artery—pulse jerking and rapid—great action of heart, and much anxiety of countenance—it was evident that in a very few hours the limb would be a mortified mass—he now implored to

have the limb amputated, and the request was immediately complied with.

The femoral artery, when divided by the incision, pulsated furiously ; it was very firmly tied, and after its inclusion in the ligature it was propelled outward from the surface of the stump with incredible force ; some other vessels being secured, the stump was left open for a few hours, in order that the bleeding might be watched. He died of secondary hæmorrhage within forty-eight hours after the operation, and, on examination, the artery shewed an aperture capable of admitting a large probe immediately behind where the ligature had been secured—from this the bleeding came—the artery did not appear unhealthy or altered in structure, and it was, therefore, inferred that it was ruptured by the inordinate action of the heart.

The heart was nearly twice its natural size.

Thus, when, as in the above case, there is proof of the existence of organic disease in the heart, or of the presence of an internal aneurism, or if there are two or more external aneurisms indicating a general disposition to the production of the disease, the operation ought not to be performed ; and yet, when the test of experience is applied to this precept, a vast deal of uncertainty will be discovered, occasioned partly by the difficulty of obtaining proofs of the existence of internal disease, and partly by the difference in the constitution of indivi-

duals. I have already mentioned that the stethoscope is sometimes ineffectual in discovering an internal aneurism, and I know not how far it can give *certain* indication of the existence of organic disease of the heart, for I think I have seen cases that had not been discovered during life ; but of this I feel assured, that great irregularity and excitement of the heart's action may exist, not the cause, but the consequence, of local disease.

In a case of popliteal aneurism, I have known a patient to suffer from terrific palpitations, with occasional fainting fits, and other symptoms of disease of the heart, to the extent to render the propriety of an operation rather questionable ; yet the man could not be left to die : the femoral artery was tied, and before the patient was removed from the table all these symptoms had subsided. They had been produced and maintained by the irritation of the aneurism, and eventually no case could have had a more happy termination. Again, where there are two aneurisms in the one individual, the circumstance may not be a positive bar to the operation.

In the Meath Hospital, (during the winter of 1833-4,) was a patient who had a popliteal aneurism in each leg : he was operated on for both by Mr. M. Collis, an interval of six weeks being allowed between the recovery after one and the performance of the second, and the result was in every way satisfactory. As the man was lost sight of after leaving the hospital, it cannot be

ascertained whether disease reappeared in any other situation ; but, at all events, life was evidently prolonged. Such cases as these are certainly deviations from the ordinary results of experience, but they are useful in shewing that, as there is no proposition in medicine or surgery universally true, so is there no rule of practice unvaryingly stringent.

2. It being decided that something is to be done, the next point to be determined is whether we are to make the attempt to save the limb or advise that it should be amputated. This question is often of the greatest importance in cases of diffused aneurism, where it may decide on the safety or destruction of the patient, and therefore shall be more particularly discussed in the section relating to that form of the disease : at present I confine my remarks to the common circumscribed forms of the affection. Are there, then, any circumstances that might oblige a surgeon to propose amputation, rather than trust to the operation of a ligature ? Many have been suggested, which I shall endeavour to notice in their order ; and first, as to the possible complication of a carious bone. The effect of the pressure of an aneurism in the production of dry caries, has been already mentioned, and it is obvious that a limb so circumstanced will not be in a condition very favourable to recovery. Fortunately, except in the instance of the popliteal arteries, the large vessels are not generally situated close upon the bones, and therefore in external aneurism this complication is rarely met with. Even in the popliteal

space, a tumour must have increased to a very large size before it could have produced this effect; and now-a-days few patients will permit such an occurrence without applying for relief. It is not often, then, that this unpleasant symptom presents itself; but when it does to any extent, it may form a very sufficient reason for giving a preference to amputation above any other operation.

The next circumstance that should cause hesitation in the application of a ligature is that of the aneurism having grown to a very large size. The chief cause why this ought to be considered unfavourable has hitherto been an apprehension lest the sac might subsequently become the seat of suppuration; but perhaps it is to be dreaded for far more important reasons. It will be recollected that at all times some little dread has been entertained lest the ligature of an arterial trunk should be followed by a gangrene of the limb, and it is quite certain that mortification sometimes attacks a part so circumstanced. This has usually been attributed to the obstruction of the main vessel, and the inability of the collaterals to convey a sufficient supply of blood: but there are no grounds or reasons to countenance such a supposition—first, because the contrary has been proved by experience, in thousands of instances; and, secondly, because gangrene, when it does occur, is not of the dry and shrivelled kind that seems to arise from diminished circulation and imperfect nutriment, but humid and moist, like that occasioned by a congested state of the



veins, and an accumulation of blood within them. It has been remarked, (I think by Guthrie,) that if either the artery or vein is wounded, the limb may be preserved notwithstanding; but if both are injured, amputation must be performed, else gangrene will ensue. In modern times it does not often occur that both the artery and vein are included in a ligature; but I have seen the vein torn and perforated by the needle, and death was the result. It seems that if the artery is closed, the vein remaining open, there is ample room or opportunity for the return of the blood—if the vein is closed, the artery remaining open, the impetus of the circulation assists the return through the superficial and other collateral channels—whilst, if both artery and vein are closed, the impetus of the heart intercepted and removed from the capillaries, and the passage through the vein impeded, the blood becomes congested in the veins, and mortification ensues in consequence. If, then, the tumour is very large, and has already interfered with the return of the venous blood—if the limb has become œdematous and painful—if the superficial veins are enlarged, and ramify numerously under the surface of the skin—or, if the limb is deficient in animal heat—there will be reason to dread the results of tying the artery; and, probably many cases of mortification that have either not been accounted for, or attributed erroneously to other causes, might, on closer investigation, have been traced to this. It is also worthy of observation that in cases of large popliteal aneurisms, although a cure of the chief and important disease may have been effected, the patients

are liable to abscesses of the limb, and to tedious and inveterate ulcers of the leg for a long time afterwards, or, it may be, during their lives.

When the sac of an aneurism contains such a quantity of blood that the absorbents are incapable of removing it, after a little time it becomes literally a foreign body, irritates and occasions the inflammation of the sac, and the formation of matter within it. This abscess, which generally occurs about six or seven weeks after the ligature has been applied, contains a quantity of purulent matter, often very fetid, mixed up with masses of coagula; and the exposure of a very large cavity in such a condition, together with the wasting suppuration and hectic that would be likely to ensue, have together created so much apprehension in some practitioners, as to induce them to recommend amputation in the first instance. But this is a rule by no means admitting of general, far less of universal, application; for many very large aneurisms have been removed by the absorbents, and many more, when opened, have healed kindly, like the cavities of other abscesses. It should be recollected that, except in some singularly unfortunate cases, the artery has been obliterated before the sac becomes inflamed. There is no danger from hæmorrhage on opening the tumour; and the proper mode of treating such a case would be, to make a free and extensive incision into it, discharge all the matter, turn out every particle of coagulum, and then apply pressure, in order to promote the agglutination of its opposite sides. The

sacs of two subclavian and one carotid aneurism under my care suppurated, were thus treated, and recovered without trouble, and even without an unpleasant symptom. In fact, a suppurating sac is only an abscess, by no means of necessity an unhealthy one, and it would be a frightful collection of matter that could induce a surgeon of the present day to perform amputation of the thigh.

Lastly, when patients are so far advanced in years that there is a probability of the arteries being affected with the earthy or bony deposit so frequent at that period of life, it has been considered somewhat hazardous to apply a ligature, inasmuch as this unorganized brittle substance would be likely to break down under the pressure of the cord, and immediate hæmorrhage ensue. Amputation has been proposed, to afford an opportunity for the inclusion of some muscular or other substance, along with the artery within the noose. But I consider this apprehension to be groundless. In the healthiest artery the internal and middle coats are divided, and the ligature is sustained by the cellular one alone, and no more can happen with the artery of the aged person, because this earthy material has no connexion with the cellular tissue. It might indeed happen that a vessel thus circumstanced would not go through the process of adhesion and obliteration, and therefore there might be risk of secondary hæmorrhage; but there can be none of its immediate occurrence. I shall have occasion to revert to this subject again, when discussing

that of consecutive hæmorrhage: here it will be sufficient to state, that the objection appears to be theoretical rather than derived from practice. I have operated on an artery of this kind without any unpleasant result, either immediate or remote, and would have no hesitation in doing so again, if urged by the necessity of the case.

Having now considered the cases in which it had been supposed amputation should be resorted to, and found that the apprehended dangers were in many instances only imaginary, I proceed to those in which a cure may be hoped for without having recourse to such severity. Having already stated that the pathology of aneurism has reference to two points—one the hæmorrhage from the open vessel, and the other the fact of this hæmorrhage being internal—the treatment naturally divides itself into that by which the bleeding is stopped; and, secondly, the removal of the effused blood from the limb. Now, although it is probable that the principle on which a cure is completed is different according to the pathological condition of the artery, its being ruptured or only dilated, yet the means used are the same as those by which we might hope to accomplish the complete obliteration of the vessel at the injured spot. They are,

1. Pressure on the tumour from without.
2. Ligature at the cardiac side of the tumour; and,
3. Ligature at the distal side.

1. The treatment of aneurism by compression is so

obvious, so simple, and apparently so safe, that one might be led to express surprise that every case is not subjected to it as a matter of experiment before severer measures are adopted, more particularly when it is recollected that numerous cases of recovery have occurred, even where such good fortune could hardly have been anticipated. Some years since, a man suffering from aneurism, was admitted into the Meath Hospital. The tumour was situated low down in the popliteal space, and was large, being fully the size of a turkey's egg. The limb was semiflexed, and could not be extended : pain very considerable, together with a sensation of numbness and tingling in the foot : tumour not compressible, at least pressure influenced its size but slightly : it was hard, and did not diminish in bulk when the femoral artery was compressed, which, however, stopped the pulsation. With a view to humour the patient, until he could be persuaded to submit to an operation which I conceived to be absolutely necessary, I rolled a bandage round the entire limb, from the toes upwards. This, as the idea of treating the disease by compression had never been contemplated, was very loose ; nor had I the least notion that the tumour could have been influenced by it, one way or the other. But, on my visit the next day, the aneurism was gone. Within an hour after the application of the bandage, the patient experienced some pain in the tumour, which soon became excruciating, and continued the entire night. In the morning the tumour no longer pulsated—it had become solid and firm, and eventually the disease was cured.



On another occasion a man was admitted into the same hospital, under the care of Mr. M. Collis, with a popliteal aneurism, the history of which I do not recollect with very great accuracy, except that it was rather of large size, not compressible, and there seemed not to be much fluid blood within the sac. A bandage was applied to this in a similar manner to that in the former case: it caused immense pain; and in the following morning the pulsation in the tumour was no longer to be remarked. It, however, reappeared after a little time, but so very indistinctly that it was a questionable matter whether the sensation was not communicated from the finger of the examiner, and not from the tumour. The application of the bandage was persevered in, and, in the course of a very few days, no doubt could be entertained of the cure.

Such instances of inexplicable recovery are extremely rare, and, as examples of singular good fortune, are rather to be hoped for than expected; neither can any principle of practice be established on them; but I have occasionally seen compression used in another way with such great success as would, with most practitioners, sanction its adoption in every similar case. The cases I principally allude to were treated in Stevens' Hospital by my friend,\* Mr. Cusack. As some of them have been published, it will be unnecessary here to state more than that the disease had been the consequence of wound—that the patients were young and healthy men—that the

\* Dublin Journal of Medical Science, v. 1, p. 117.

compressing force was evenly applied over the surface, and gradually increased, having been very gentle at first—and that the treatment was assisted by the topical application of cold, and the internal administration of digitalis. Within a very short time past, a patient in the same hospital, and under the care of the same distinguished surgeon, was treated in a similar manner, with the most signal success, for an aneurism of the anterior tibial artery, caused by the wound of a chisel.

Having so far discussed the treatment of aneurism by compression in its most favourable point of view, it is but fair to examine the other side of the question, and inquire, at least, why it has not been more generally adopted: and here it may be remarked that the theory of the disease is altogether opposed to this line of practice. Thus, in the first instance, an aneurismal artery, in order to be in a state favourable for the employment of pressure, should be subject to the same conditions that have been already mentioned as necessary to the cure of external hæmorrhage by compression—that is, it should be otherwise healthy, superficially placed, resting on a bone, and unaccompanied by either nerve or vein. Again, a bandage, if sufficiently tight to empty the sac, and prevent the influx of any additional blood, is usually attended by great pain, so great as often to have induced patients to remove their bandages, notwithstanding the most serious warnings of the consequences of such a procedure. Lastly, pressure to the requisite extent may possibly rupture the sac, and con-

vert the circumscribed into the worst form of the diffused aneurism, a circumstance that would be likely to be attended with the most disastrous results. With these considerations before me, I can easily understand why it has been so seldom attempted in cases of aneurism, and why it has still more unfrequently proved successful. It may certainly be warrantable to try it where the disease has been the consequence of a wound, and the vessel may be presumed to be otherwise healthy; but even then the size of the tumour becomes the subject of important consideration. If an aneurism is small, the compress may possibly be so placed as to lie directly on the cicatrix of the sac, thereby supporting it, and preventing its contents from being diffused; but if it is large, the situation of the puncture will probably be towards one side, and then pressure on the centre will rather have a tendency to force it open and drive out its contained blood amongst the cellular tissue of the limb.

On the whole, it would be difficult to lay down directions that might be applicable to the management of every case. Many persons cannot be brought to regard the possible result of compression in this formidable light: many others are unable to divest themselves of terror at the thought of secondary hæmorrhage, and will therefore avail themselves of any mode of treatment that can save them from this much-dreaded evil; and as every surgeon can, within his own experience, adduce instances of unexpected recovery under compression,

perhaps each must be permitted to determine this question of practice for himself. There is something in the pathology of the arterial system to be discovered still—something that predisposes to the occurrence of secondary hæmorrhage, and that when discovered may explain the discrepancy in the results of apparently similar cases. I am acquainted with one practitioner who has tied almost every artery in the body that could be reached, and, after an experience of more than twenty years, has as yet had the good fortune never to have had a case of consecutive bleeding on the separation of a ligature, whilst other surgeons, in cases apparently as favourable, and after operations at least as well performed, have been absolutely harassed by the frequency of this unpleasant occurrence. The opinions of men on this subject, then, although founded on experience, must exhibit a considerable variety, and that of any one individual can carry but little weight; it has, however, been my lot to witness some cases of circumscribed aneurism rendered diffused by pressure; and having seen the patient's distress and danger, the painful, the tedious, and difficult operations he had to undergo, and the hazard to which life was exposed afterwards; and having well weighed the different contingencies that may occur, I have come to the conclusion, in my own practice, not to resort to compression, unless there was some insurmountable objection or obstacle to the employment of the ligature.

## TREATMENT OF ANEURISM BY LIGATURE.

Historical Sketch—Ligature at the Cardiac side of the Tumour—Principle on which a cure is effected different in the false Aneurism and the true—in the false—progress of a successful case—in the true—proofs and illustrations—Ligature at the distal side.

The very early history of any disease is generally uninteresting, because its treatment, if not founded on pathological principles, cannot be either rational or scientific, and on this account the history of aneurism must be miserably defective, when it is remembered that the circulation was not discovered until the seventeenth century,\* and even then and afterwards was not received without difficulty and disputation. One of the first who treats of any operation for the cure of aneurism is Philagrius,† who tied the artery above and below, and then cut away the tumour; but it seems he was anticipated in, at least a part of his operation, by Antyllus,‡ called by Sprengel the inventor of the ligature, who tied the artery above and below, cut into the tumour, emptied it of all the grumous blood, and then filled the sac with suppuratives. §Lanfranc was the first who advised the actual cautery as a means likely to favour the suppuration, and the cure of an aneurism, and he was followed

\* Hervey demonstrated the circulation, 1619.

† A. .D 364.

‡ A. D. 330.

§ Surgeon to the Hotel Dieu, 1294.



by very many, but with such scanty success that, in the sixteenth century, the best surgeons trusted to compression, amongst whom was Ambrose Paré the inventor of the ligature for wounded arteries. About that time the Abbè Bourdaloue compressed an aneurism in the bend of the arm with success by means of some species of tourniquet—an instrument that has since been used with so many modifications. In 1710, Anel tied the artery close to the sac, and left the tumour to itself; and hence the French, obviously jealous of the improvements effected by British surgery, endeavour to deprive John Hunter of the glory of his invention, by attributing it to Anel, and calling it by his name. But the absurdity of this becomes apparent when it is recollected that one of Hunter's chief objects was the tying of the vessel at a distance, inasmuch as he had usually found the part of it near the tumour to be in a state of disease.

In the month of December, 1785, Hunter performed his first operation on a coachman; and then the French, having failed in establishing the claim of Anel, state that it had been done by Desault in the June of the same year; but it was unquestionably first given to the world by Hunter, in his lectures, and was published by his brother-in-law, Sir E. Home. His objects were—to prevent the entrance of the blood into the sac by cutting off the impulse of the heart—to tie the vessel at a part where it was free from disease, and he left the removal of the coagulum to the absorbents; and so far he was correct, but his operation was clumsy and ill-conducted,

owing to his imperfect acquaintance with the pathology of the arterial system, and he may well be pardoned, when we find Scarpa, in nearly twenty years afterwards, operating in a still more objectionable manner.

Hunter's chief dread seems to have been that of secondary hæmorrhage, and he placed under the vessel no less than four ligatures, one of which (the lowest) only was tied, and the others left ready in case the vessel should subsequently bleed. Scarpa had the same apprehension, and not only left the ligature of safety, as it was called, but introduced a rouleau of linen between the artery and the cord, in order to prevent its being cut or otherwise injured. The experiments of Jones, published, I believe, in 1810, dissipated the fear of cutting the artery across by the ligature, and even shewed that the division of the internal and middle coats, if not absolutely necessary, was certainly conducive to its future obliteration.

In the second edition of Scarpa's work, we find him strongly inculcating the advantage of not detaching the vessel from its connexions to an extent beyond what will merely permit the needle, armed with the ligature, to be passed round it. I need not now notice Mr. Abernethy's suggestion, of tying two ligatures and dividing the vessel between them, because I shall have to revert to it in treating of secondary hæmorrhage, but merely state that, by gradual and successive improve-

ments, the treatment of aneurism has been brought to its present state of simplicity ; and, as far as operative surgery is concerned, of perfection.

I cannot find that any very serious objections were made to the tying of arteries on the ground of the danger of mortification attacking the limb, in consequence of its supply of blood being interrupted. Such matters were spoken of, and even Heister and Morgagni endeavoured to account for the success of some operations by supposing the existence of two trunks in the limb, one of which only was tied, while the other might carry on the circulation. But, in opposition to these speculations, facts were daily occurring, and whilst surgeons *spoke* of such possible dangers, they nevertheless tied the arteries with boldness and success ; and since the publication of Scarpa's dissections of the collateral circulation, no one entertains the smallest doubt of its capability of conveying a sufficiency of blood, even though the largest trunks should be obliterated. Indeed, I believe there is more danger of the failure of an operation from the anastomising branches carrying too much blood than too little. But still it may be well believed that some lingering apprehension might have remained with regard to operations on the larger trunks, whether from their giving off fewer anastomotic branches, or the danger of suddenly interrupting a very large current of blood, and, therefore, the persons who first undertook them are entitled at least to the merit of enterprise and decision. In the year 1796, only eleven years after the

performance of the Hunterian operation, the late Mr. Abernethy tied the external iliac artery, and since that time the operation, which is really a very easy one, has become extremely frequent; amongst others, Mr. Kirby of this city, performed it at a very early period with the most complete success. The internal iliac was tied by Mr. Steevens, of Santa-Cruz, in the year 1812, with the most gratifying results, for the patient lived several years, and after death an opportunity was afforded for observing the effects of the operation, which were, in every respect, satisfactory. The common iliac was first secured by Dr. Mott, of New-York, then by Sir Philip Crampton, next by Mr. Guthrie, and lastly by Dr. Salomon, a Russian practitioner, who was largely rewarded for his enterprise and success; of these operations all were successful, except Sir P. Crampton's, and as the cause of its failure was purely accidental, the history of this part of surgery offers ample encouragement to future perseverance.

In 1809, the first attempt was made to tie the subclavian above the clavicle by Mr. Ramsden, and it was not until 1817 that a case was attended with success under the care of Dr. Post, of Philadelphia. In mentioning the operation of tying the subclavian, the name of Mr. Colles should occupy a very high and prominent place, as being the first who devised and executed the operation of securing the vessel on the tracheal side of the scalenus muscle—an operation that has been twice performed in Dublin since, and once by Mr. Liston, but

always hitherto without ultimate success. Baron Du-puytren took up the vessel in that part of its course where it passes behind the anterior scalenus, a mode of proceeding and a locality to which he gave a preference, and in which he was afterwards followed by Mr. Liston and Dr. Auchincloss.

In looking at the history of this part of operative surgery, it is curious to observe that all the first attempts at tying the larger trunks have been unfortunate, except only the cases of the common and internal iliacs, notwithstanding that afterwards they had the most successful issues. The carotid was first tied for the cure of aneurism by the present Sir A. Cooper, in 1802; and we have lately had a surgeon in India speaking with the utmost *sang froid* of having tied both the carotids for the cure of apoplexy. The innominate was tied in 1818 by Dr. Mott, of New-York, afterwards by Professor Graefe, of Berlin, in 1822, and more recently by Mr. Lizars, of Edinburgh; but, in all instances, the patients did not recover ultimately; and the abdominal aorta has been the subject of operation in the hands of Sir A. Cooper and Mr. James, of Exeter, but unfortunately with a similar result. Having mentioned these different operations, which it will be seen are particularly creditable to the enterprise of British surgeons, I turn to discuss the principle of the treatment by ligature, and the objects proposed to be effected thereby.

I have already mentioned, that a ligature has been



placed on the trunk of the vessel for the cure of aneurism somewhere between the heart and the situation of the tumour; this is termed the ligature at the cardiac side, it is the operation most commonly performed, and, where practicable, should always be preferred to that of the distal side, which consists of the application of the cord around the vessel between the tumour and the capillary circulation, but as close as possible to the former. Now, although the object sought in both these operations is pretty nearly the same, namely, the coagulation of the blood within the sac, and the same result is frequently produced in the obliteration of the open and bleeding vessel; yet it is manifest that they cannot accomplish these ends exactly in the same manner, and therefore it will be necessary to consider the principle of these operations separately and distinctly; and first, with respect to that with which all surgeons are most familiar, the ligature at the cardiac side.

The mere performance of a surgical operation, however boldly undertaken and dexterously completed, is but a small part of the cure that is hoped to be attained by it; certainly it is the first step, and the most essential of the process, because it interrupts Nature where she is working injuriously, and turns her efforts and her energies into a new and different channel where it is expected they may have a salutary effect. If a surgeon then wishes to be any thing more than a mere servile imitator, or the worst form of empiric, it is essential that

he should be acquainted with every step of these new processes, else how can he hope to assist them when they are languid, or relieve them when oppressed ; and no where is such knowledge of greater importance than in the pathology of the arterial system. It involves the capability of a prognosis, or the distinguishing the case in which there is a probability of these processes being healthily carried forward, and it is even more necessary in anticipating a failure or an irregularity of them, and providing against such contingencies ; under these circumstances, I can conceive no subject more interesting than the pathology of our operations on the arterial system, nor one more likely to repay the labour of investigation ; for it will be seen hereafter that, notwithstanding the researches of so many eminent men in this department, a great deal remains to be discovered still.

And first, I imagine the process by which aneurism is cured by the application of a ligature at its cardiac side, is not the same in the false aneurism and in the true : at least it is difficult to explain the varieties met with, or any other supposition. In the false, the great object to be accomplished is the removal of the impulse of the heart from the blood contained within the sac for a sufficient time to allow of this reservoir becoming slowly and gradually filled with blood, and for that blood to become firm and coagulated. This coagulum, then, is pressed upon or against the wounded and bleeding vessel, and produces those consequences within it that terminate in its obliteration ; the blood, if the case pro-

ceeds favourably, is afterwards absorbed, and the sac, in process of time, is converted into a solid piece of ligamentous substance similar to that into which the arterial trunk has degenerated. The completion of this process requires different periods of time, according to the size of the vessel, the dimensions of the sac, and the quantity of fluid blood it can contain, but is always accomplished long before the separation of the ligature, and, therefore, if there could be any other means devised for removing the impulse of the heart during the required period, a ligature need never be applied for the cure of aneurism.

Such contrivances have been attempted, the most remarkable of which is the "presse artere" of Deschamps, an instrument that can be placed on an artery in such manner as to stop the current of blood, remove the impulse of the heart for any given time, and afterwards be withdrawn without violence whenever the operator feels satisfied that his object has been accomplished. Unfortunately none of these expedients have yet been found to answer the desired purpose, and, perhaps, for the simple reason, that the degree of pressure requisite to stop the blood will, in the great majority of instances, be sufficient to occasion inflammation in the artery, and, therefore, the case has to run the same course as if a ligature had been applied. Hence the adoption or rejection of any form of "presse artere" would entirely rest on a comparison between the results of cases treated by it and by the ligature, and this test has hitherto

seemed to be unfavourable to these instruments. Some of the most formidable cases of secondary hæmorrhage I have ever seen, were after the employment of the presse artère of Deschamps, and of late years it has fallen totally into disuse, at least in this country. If this is a correct explanation of the principle on which the cure is effected, it follows that the essential parts of the process are—first, that the blood within the sac should become coagulated, and secondly, that the pressure of the coagulum should be directed fully and fairly against the open vessel so as to cause its obliteration. If we could conceive a case in which the blood was so unhealthy or so unnatural as to be incapable of coagulation, it is probable the treatment of such case would be imperfect and incomplete, and the practical result of any interference with the process of coagulation is often well exemplified in the cases where pulsation returns in the sac after operation, which cases are always tedious in their progress, and uncertain as to their termination. Again, if the pressure of the coagulum is capable of acting in any direction but that of the artery, it might as well not be there at all, and the want of this essential will be obviously exemplified hereafter in treating of traumatic aneurism, a form of accident to which the ligature at the cardiac side is altogether inapplicable from this simple circumstance alone.

At the moment in which a ligature is tightened round an artery, the patient frequently experiences severe pain—I have known persons at such a moment to give

vent to their feelings in a yell of agony, probably when some little fibril of nerve had been included : sometimes this does not occur, and then the first appreciable symptom is the cessation of pulsation in the aneurismal tumour, and its sudden collapse and diminution of size. In a short time afterwards, the temperature of the limb operated on becomes sensibly less than that of the rest of the body : but this symptom only endures for a few hours, after which it is uniformly found to be increased by two or three degrees. At this period, the part has been supplied with blood by the collateral circulation ; the trunk of the artery below the ligature is filled, and gives to the finger the sensation of a very soft and compressible cord ; the aneurismal sac is filled also, and may attain even to a greater size than it possessed before the operation, but the blood passes into it slowly, and without impetus, and no portion of it is again forced back into the circulation ; it, therefore, coagulates, and comes to press upon and close the ruptured vessel, which is soon obliterated by inflammation, and, in some time afterwards, degenerates into little more than a ligamentous cord. The farther progress of the case, when it terminates favourably, has been already described in treating of the application of a ligature to a bleeding artery ; its unfortunate terminations are to be noticed hereafter.

The only remaining point of treatment has reference to the blood that has accumulated within the sac, and



this may be dismissed almost with a single word—it must be left untouched—it cannot be interfered with. It is one of the greatest excellencies of Hunter's operation, that he trusted to the power of the absorbent system for its removal, and in successful cases such is the termination to be expected. The tumour diminishes in size, and becomes hard and firm, and sometimes disappears altogether in process of time; in the generality of cases, however, a small kernel-like knot (the remnant of the sac itself,) continues for ever afterwards. When the case has not this termination, it is usually in consequence of the effused blood acting as a foreign body, and producing inflammation and suppuration of the sac. This will be more likely to occur where the aneurism has been large, and the accumulation of blood great; but I have seen it occasionally in cases of an opposite description. In several instances I have evidently traced this unpleasant accident to a too frequent and injudicious examination of the tumour—in fact, to handling and compressing it to see if it was rapidly subsiding. It is painful, and may appear ungracious even to seem to repress the laudable zeal for inquiry and investigation that ought to be the characteristic of every student as well as of every surgeon; but in cases of aneurism, an over-weening curiosity may be worse than useless—it may be injurious, or even destructive to the patient. The tumour, then, should not be tampered with; there should be no feeling or pressing upon it: no examination not absolutely necessary; not even

an external application intended to promote that process which Nature, if not disturbed, will effect by herself in the best, the safest, and most efficacious manner.

I am not in a condition to determine decisively whether true aneurism is cured exactly in the same manner, and by precisely the same process, as that which has been detailed as occurring in the false; and I do not know of any inquiry likely to be attended with greater difficulty. True aneurisms very rarely occur in arteries that can be made the subjects of operation; and when they do, they are seldom operated on until they have become of the mixed form, or so altered by growth or other circumstances that it is impossible to *demonstrate* their nature; besides, when an aneurism is cured, the patient is very generally lost sight of; in the lapse of years the circumstance may have been forgotten; the friends of the patient may refuse an examination after death—or the surgeon that operated may not be particularly devoted to pathological investigation; all these causes tend to interfere with and prevent inquiry into this very interesting portion of pathology. Under such circumstances, I can have but few facts to rely on—and the most I have to suggest is only conjecture; but this subject, curious as it is, has hitherto been sadly neglected; and conjecture will be useful, if it only arouses the attention of others in order to its confirmation or disproof. I do not, then, think that the same principle of cure obtains in the true aneurism and in the false; but in order to understand this position, it will be

necessary to consider more fully the nature of this latter affection.

The early history of aneurism is involved in the greatest obscurity; but there is good reason for believing that the prevailing, if not the universal, pathological doctrine, antecedent to the time of Fernelius, was, that it was caused by rupture, wound, or ulceration. This surgeon first entertained the idea that it must be formed by dilation, because the tumour would not pulsate unless furnished with an elastic covering, and because if the blood was withdrawn from the circulation, it ought of necessity to stagnate and become putrid. Although the futility of these arguments (particularly of the latter) must soon have been made manifest, it does not appear that the doctrine founded on them was relinquished, for we find Scarpa industriously combating it, and endeavouring to establish that aneurism was always produced by rupture or ulceration. He did not deny that arteries were occasionally dilated—he had seen and described these dilations; but it is evident he referred to the dilation of the entire tube in which the blood does not stop or become coagulated—he denied these to be specimens of aneurism, and even here he probably was not right, so far as the symptoms of the disease are concerned. But he also denied the dilation of an artery at one particular spot into a sac, and in this he certainly was mistaken.

However difficult of demonstration, and in some in-

stances the difficulty is almost insurmountable, nothing can be better established than that a true aneurism may be formed of or by a seeming dilation of all the coats constituting a sac connected with the artery at one spot, and containing coagulated blood. In most instances of aneurism, particularly when the tumour has attained any considerable size, the wall of the sac is so thickened, and all the structures are so matted together and confused by depositions of lymph and fibrine, that the appearances are rendered most deceptive, and a very patient investigation will be necessary to develop the morbid changes. But there is one circumstance which, when observed, at once demonstrates that the aneurism has been produced by dilation, and not by rupture or ulceration. It is when the wall of the sac contains depositions which are only met with in the structures of the artery, such as the peculiar earthy scales that are formed in the vessels of aged persons, and the soft steatomatous material that may be the product of unhealthy inflammation at any period of life; of this condition of sac I have already published a number of examples which consequently need not be repeated here.

But I have said that Scarpa was probably not correct when he stated that a universal dilation of an artery, the result of disease, was not aneurism; and here, in order not to be misunderstood, I must refer to the description of the sixth form or species of the affection, as given in the second section. I entertain no doubt that there is a pathological condition of an artery producing

all the symptoms of circumscribed false aneurism, and apparently curable by the same means—that is, by the application of a ligature at its cardiac side. It seems to be formed by a dilation of the fibrous and cellular coats, and the absorption of the internal lining; and thus is so far a true aneurism as that the artery is uniformly dilated around its entire circumference, and so far a false one, that the internal lining membrane has been removed. I have not given this disease a name, but shall treat it practically along with true aneurism, because the principle of the cure is the same: but first, it may be necessary to prove at least its occasional occurrence. In March, 1835, a man was admitted into the Meath Hospital, with popliteal aneurism in each ham, one of which had existed for several weeks; the other was of recent occurrence. The limb in which the larger and older one was situated was first made the subject of operation—the femoral artery was tied, but the patient died on the sixteenth day afterwards, the ligature on the vessel still remaining firm and undetached. Dissection shewed that both these aneurismal sacs had been formed by the entire and equable dilation of the fibrous and external coats of the arteries, and that the lining membrane had in both instances been absorbed. This case has been published more at length in the *Cyclopaedia of Anatomy and Physiology*, vol. 1., where is also another of exactly the same nature, which I shall transcribe at length, as exhibiting the principle on which this form of aneurism is probably cured by operation. “A man was operated on by Mr. Collis, in the Meath Hospital,



for popliteal aneurism, on the 22d of January, 1831. The ligature came away on the seventeenth day—the tumour diminished; in short, every thing went on well, and the patient left the hospital perfectly cured. So far as the aneurism was concerned, he remained healthy and free from inconvenience until his death, which happened in March, 1835, from fever, and such an opportunity for pathological inquiry was not neglected. The tumour, which had been originally of the size of a turkey's egg, was found to have diminished to little more than that of a walnut; externally it felt hard, and as if solidified. On being cut into, however, neither artery nor sac was obliterated—the latter being occupied by a coagulum of a deep red colour, through the centre of which was a canal of a sufficient size to allow the blood from the portion of the artery above the tumour to flow freely into that below it. It seemed as if the current of blood through the sac had never been interrupted, the only effect of the ligature having been the removal of the impulse of the heart from it. This aneurism appeared to have been a true one, so far as the fibrous and cellular coats were concerned; but the fact could not be so satisfactorily demonstrated as to admit of no dispute; however, the absence of the lining membrane, and its sharp and abrupt terminations at the healthy portions of the vessel, were sufficiently obvious." This very interesting preparation was sent to the school in Park-street, where I believe it is preserved in the museum of that establishment, and there is a beautiful

specimen of the same disease belonging to the school museum of the Royal College of Surgeons.

Again, in July, 1836, another example occurred in the Meath Hospital, in a case of aortic aneurism, in which the patient died by the bursting of the tumour behind the peritoneum; here it was evident to the eye that the internal tunic had been removed by absorption or ulceration from all that part of the vessel that entered into the formation of the aneurism, and that the tumour was produced by the universal and equal dilation of the remaining coats was proved by the existence of three large branches coming off in different situations from the dilated vessel, each of sufficient size to admit a goose-quill easily. So far I have endeavoured to prove that there is such a pathological condition of artery producing all the symptoms of aneurism—terminating fatally as other aneurisms do, by bursting—and curable by the application of a ligature at the cardiac side: we have now to consider the surgical pathology of this affection a little more in detail.

Whenever an artery is dilated, either wholly or in part, the dilated portion is uniformly found after death filled with coagulated blood: it seems that under such circumstances the fibrous coat is so far weakened as to be incapable of emptying the vessel after it has been filled by the last stroke of the heart, and the blood that is within it remains there; and I imagine something of

the same kind takes place during life, when the impulse of the heart has been removed by the interposition of a ligature. In October, 1838, I tied the external iliac artery very high up, for the cure of an aneurism of the femoral artery, the superior edge of which passed above the margin of Poupart's ligament. The operation was unsuccessful, and the patient died on the fourth day, of diffuse inflammation, transferred by metastasis to the lining membrane of the left side of the heart. On dissection, the aneurism proved to have been of the mixed kind. The femoral artery, for about four inches in length, was dilated to three or four times its natural diameter, and from the external side of the dilation a sac sprung, of more than the size of a small orange. All the dilated portion of the vessel was filled with a firm coagulum of blood, of a very dark, deep-red colour, whilst the remainder of the artery, both below the tumour, and between it and the ligature, was empty, and presented the usual appearances that arteries do after death. From this case I infer—1st, that the contractile force by which an artery is emptied immediately previous to death, exists in the vessel, and is wholly independent of the heart, inasmuch as any assistance to be derived from the latter had been here intercepted by the ligature; and, 2dly, that that force (whatever it may be) did not exist in the dilated portion of the vessel. Now, if reference is made to the manner in which blood circulates through a dilated vessel during life—that the dilated portion is always full, and is expanded during the diastole, by the influx of a very small wave of blood sent by the heart,

and is diminished by the exit of a corresponding portion, caused more by the elastic resistance of the parts covering the artery than of that of the vessel itself—it will not be difficult to perceive that the circulation of the blood through an artery the vital qualities of which are thus impaired, the constant disturbance of the fluid within it, and the prevention of its coagulation, depend upon the heart, and that the blood will stagnate and become coagulated, when the impulse derivable from that organ is lost. It is thus that I conceive true aneurism is cured. Certainly, I cannot speak decisively with respect to the partial dilation: true aneurisms very seldom spring from arteries that can be made the subjects of operation, and natural cures are so rare and so likely to be overlooked, that I have no pathological authority to guide me on the subject. I can easily imagine, however, that if by any accident the impulse of the heart was removed from the tumour, the blood would flow slowly and without impetus into the sac, remain there, and become coagulated—that the sac, when completely filled, and no longer subject to farther distension, would admit no more blood—and that the coagulum thus perfectly at rest would gradually be absorbed, and the tumour be proportionally diminished in size. The process of cure would necessarily be tedious, but I think might be eventually completed, the canal of the artery still remaining open and pervious. But for the case of universal dilation there is something of pathological authority: we know that the aneurism may be cured, not only without being obliterated, at the end of four years, but with evidence

that the blood had actually circulated through it, up to the moment of death, and all that remains is to explain how this can happen.

I have already shewn that an aneurism grows and increases by the introduction of a fresh wave of blood at every contraction of the heart ; when this impulse is removed, it can grow no more. I have assumed that a dilated artery is so far diminished in vital energy that, independently of the assistance derived from the elasticity of the skin and other structures external to it, it is incapable of emptying itself of its blood. Therefore, when the impulse of the heart is intercepted, the blood that flows into the diseased portion of the vessel remains there, and becomes coagulated ; and if there is no large collateral branch in its vicinity, I think the artery would eventually become obliterated and degenerated into a ligamentous cord : but if there is such collateral branch carrying an important quantity of blood into it, such blood may make a channel for itself (as we have seen) through the centre of the clot, and preserve the vessel pervious, without eventually preventing the completion of the cure. The difference, then, in this form of aneurism is, that the artery is not a bleeding vessel : that, until the ligature has been applied, no blood is withdrawn from the circulation ; and that the cure can be completed without the obliteration of the artery : for when this obliteration happens, it seems to be solely in obedience to a general law of the animal economy, which tends to the closure of all canals,



when no longer permeated by the substances for which they were designed to afford a passage.

The only mode of treating external aneurism by ligature that remains to be discussed is that of applying it at the distal side, or between the tumour and the capillary circulation; it is an operation which has never been performed in this country: and, therefore, although it is easy to explain the principle on which it is based, and to discuss the probabilities of its success or failure, I cannot enter into any of the details with the satisfaction and confidence only to be derived from experience. It has already been explained that when a ligature is placed on any vessel, a coagulum is formed between it and the nearest collateral branches above and below, and eventually the entire calibre of the artery to the same extent becomes converted into a ligamentous cord. If, then, in the case of aneurism, a ligature could be applied beyond the tumour, yet so close to it that no branch should intervene, it might be expected that the whole line between such ligature and the nearest branch (inclusive of the aneurismal opening and the sac,) would become filled with coagulated blood, pass through the same course that a healthy artery would under similar circumstances, and in process of time become obliterated. This is the principle on which this operation is supported, and nothing can be apparently more simple, yet still it seems open to some objection. Any one who has seen the effect of a ligature

on an artery—that the vessel becomes increased in size at the cardiac side almost immediately—that the blood is thrown, or at least seems to be thrown, with increased strength—that the artery appears struggling to free itself from the impediment—and that the aneurismal sac must, at the same moment, be subjected to a similar condition, would naturally be apprehensive of the consequence, and dread that the proposed remedy might prove an aggravation. This objection, however, has been practically met—we are assured that the blood is in a few minutes carried off by the collateral circulation, and the tumour diminishes considerably, a circumstance easily ascertained by the skin that covers it being formed into wrinkles; and moreover that this diminution is permanent, which certainly is not the case when the ligature has been applied at the cardiac side. Again, the possibility of some trivial branch intervening between the ligature and the tumour, and thus defeating the design of the operation, has been raised as an objection, but this also is met by experience; if it be true, (and I raise no question on the subject,) that an aneurism of the innominata may be cured by placing a ligature on only one of its branches, namely, the carotid, it removes the objection, but in doing so, overturns the principle of the operation also. Altogether the history of this part of surgery is favourable to the operation, but I think theory decidedly against it.

It was originally proposed by Brasdor, and first put

in practice by Deschamps, but entirely without success. It afterwards failed in still more eminent hands, and fell into disuse for a considerable number of years, until, at a comparatively recent period, it has again been brought into notice, principally on the authority of Mr. Wardrop. This gentleman operated on one case of carotid aneurism with signal success, and on another with considerable relief, although the patient could not have been said to have recovered ultimately. He has also collected the results of some cases of aneurism of the innominata, treated by tying one of its branches, and followed by recoveries that to me appear surprising, but I am not disposed to doubt the authenticity of a fact merely because I had not witnessed a similar one myself, or because it might not correspond with my own preconceived opinions. I had always imagined that the carotid was the only artery in the body to which this operation was at all applicable, and even there would have hesitated to adopt it unless in the absence of every other resource. As to the ligatures of the subclavian and carotid, for the cure of an aneurism of the innominata, I never allowed my mind to dwell on it for a moment, believing that it was necessary that both the branches should be tied; and entertaining the opinion I do, that the ligature of the subclavian, in its first stage, before it reaches the scalenus, cannot, for anatomical reasons, ever be practised with success. It appears, however, that in such a case the ligature of the carotid alone has answered the purpose, and so far experience seems to be in direct opposition to theory.

Notwithstanding all these authorities, I confess I still find it difficult, in my own mind, to place confidence in this operation, or to recommend it, except in cases where, from the size and situation of the tumour, it must be impracticable to apply the ligature at its cardiac side; then, indeed, the patient would be entitled to whatever chance it might offer, however meagre that chance would be.

### DIFFUSED ANEURISM.

Two kinds—Diffused and Traumatic—Symptoms and Pathology—Treatment—Variety of Cases—Treatment of Traumatic Aneurism—General Remarks.

In the different forms of the disease I have been considering hitherto, there was at least one circumstance in which they all agreed—the aneurisms were circumscribed, and the blood withdrawn from the circulation was contained within a sac formed of the cellular sheath or other tunic of the vessel. I have now to turn my attention to the case in which no such sac has ever existed, or having been formed has afterwards been so ruptured as to allow the blood that flowed from the artery to become diffused throughout the cellular tissue of the limb, separating the muscles from each other, and inducing a condition of parts rapidly tending to the production of gangrene. As the circumscribed is more frequently the consequence of disease, commencing from within, and thence passing outwards through

the fibrous coat, so this is generally occasioned by violence acting on the vessel from without, and wounding or rupturing its external covering in the first instance. Diffused aneurism may exist under two very different conditions, (at least practically, and with a view to its treatment it is desirable to form such arrangement,) one in which either the sac of a circumscribed artery has been ruptured, or an artery opened by some force or cause which, at the same time, has not produced any external wound—such as the rough fragment of a broken bone, or the irritation or actual puncture of a sequestrum in necrosis; the other, where there is an external wound so leading down to, and communicating with, the injured artery as to permit the escape of a portion of the blood from it. This latter is the essential condition of traumatic aneurism. Thus, the affection may have been produced by a wound, yet if that wound is healed, or not being healed, if it is very oblique, or if there is any circumstance that prevents the blood from passing out of the limb or part, it falls not under the appellation of traumatic aneurism. It is necessary to be precise on this point, for it *seems* to be a misapplication of the term, the word “traumatic” being generally used in surgery to imply that the symptom or condition referred to has been the result of external violence; here, however, it is much more limited, and is confined to one particular class or condition of injury. Thus, a student, in bleeding a patient in the arm, may puncture the artery and an aneurism be the consequence, yet if the wound heals, it is not a trau-



matic aneurism nevertheless, the latter condition implying the existence of a wound through which fluid blood might trickle, or a coagulum protrude.

In either case of diffused aneurism there is always very great danger, partly arising from the loss of blood, but more particularly from the presence of the blood within the limb inducing a state of mortification; but this latter peril, being always proportioned to the extent to which the diffusion has reached, may be considerably modified by circumstances. Thus, if the wounded artery is firmly bound down by a fascia, or if there is any other obstacle to the free and rapid passage of the blood upwards and downwards through the limb, the growth and progress of the disease may be extremely slow, and it is only when the fascia has sloughed, or the resistance is otherwise removed, that the diffusion becomes extensive, and the patient's danger imminent. And the worst feature of the case is, that the nature of the disease may not, and probably will not, be recognised until it is too late.

I recollect a poor man who received a blow on his leg, by the fall of a crate of glass on shipboard, whilst on his passage from Liverpool to Dublin; he came to the hospital complaining of deep and dreadful pain in the limb; but, on examination there was nothing abnormal to be found, no swelling, discoloration, tenderness, or lameness, and consequently very little attention was given to the case. In this state he went about during a

period of six weeks, from one institution to another, at some regarded as an hypochondriac, at others, perhaps, as an impostor, but at all completely overlooked, when, at the end of that time, he experienced a sensation as if something had given way within the leg, which immediately began to swell, and ran so rapidly into gangrene that amputation was performed on the following day. He died, and, on dissection of the limb, after removal, the posterior tibial artery was found ruptured, and a large quantity of blood under the deep fascia that lies behind it. A ragged sloughy aperture was seen in this fascia, and the limb in every direction extensively injected with blood. It seemed as if the artery had been injured by the original blow, and had bled under the fascia which subsequently gave way and burst, and then mortification rapidly ensued. In a case of traumatic aneurism, the shape, size, and direction of the wound; possibly the gush of a quantity of florid-red blood at the moment of its infliction; the presence of a clot in the aperture, occasionally loosening and permitting the escape of arterial blood, might assist in pointing out the nature of the accident; but here the diagnosis is of little value, because there is no obstacle to the internal hæmorrhage, the limb becomes gorged with great rapidity, and the impending gangrene so quickly supervening on a wound in the immediate vicinity of an artery will be sufficient to determine the treatment.

The great difference, then, between the circumscribed and the diffused aneurism is in the situation of the

effused blood. In the former, it is contained within a sac, forming a limited and defined tumour, gradually, and often slowly, increasing and producing different results, according to its size and situation, until, finally, it bursts, and the scene closes for ever. In the latter, it is diffused and spread in every direction throughout the limb, its quantity is unlimited, and the growth of the tumour incontrollable; the danger here is gangrene—a gangrene that occurs with such rapidity that it either is not, or seems not to be, preceded by inflammation.

The symptoms of diffused aneurism may almost be conceived and arranged from a consideration of its pathology; and yet, practically, there are few cases in which a mistake is more likely to occur. I have myself amputated a limb in a state of gangrene supposed to have followed on a simple fracture, and not been aware of the real nature of the case until dissection pointed out the complication of a wounded artery, and the extensive injection of the cellular tissue with blood in consequence. There are, in fact, many symptoms characteristic of aneurism in general, that are either wanting or but imperfectly developed in this particular one. Pulsation, for instance, which is so pathognomonic a sign, is here either absent or scarcely appreciable, and when any approach is made to it, it is little more than a weak indistinct thrill; the reason of this is easily understood—when the blood is thrown out of the vessel it lies in the cellular tissue an inert coagulated mass, there is no reacting force to recoil upon the fluid

blood and return a portion of it back into the circulation again, and, therefore, any perception resembling a pulsation can be only the result of the disturbance occasioned to whatever fluid blood may be in the neighbourhood of the broken vessel by each successive jet from it. This obviously must be very trifling. The *bruit de soufflet* also is seldom observable. I am not so perfectly acquainted with the mechanism of this sound as to be able to account satisfactorily for its absence; but this is not important, for it is by no means pathognomonic, sometimes it is not heard in cases of aneurism otherwise sufficiently obvious, and very often it can be recognised when there is no other reason to suspect the presence of such disease at all. If the artery lies deep, and the flow of blood is impeded by any fascia, it may bleed for a great length of time without affording any sensible indication, although, as in the case of the posterior tibial artery, the pain may be excessively distressing. But when the blood obtains free passage through the limb, then the case is altered; the part swells with great rapidity, becomes pale, glassy, and œdematous, if the blood is situated deeply, but is discoloured and black if it is superficial. The neighbouring joints are flexed, and any attempt to extend them causes great suffering. In a very short space of time circumscribed patches of gangrene appear, which, on separating at the edges, permit masses of very dark coagula to protrude, accompanied by an oozing, or perhaps a rapid flow of arterial blood, under which the patient must soon sink. Doubtless, if a diffused aneurism has been occasioned

by a wound, its situation and direction, the gush of blood at the moment, its arterial colour, and the difficulty of controlling the hæmorrhage, may point out what has happened; or, if there had been a circumscribed aneurism, that on a sudden lost its defined character while the limb began to enlarge above and below it, there would be good grounds for suspicion: but, in any other case, it is so difficult to separate the pain, and tension, and the other symptoms from those which might naturally supervene on a severe injury, that the appearance of a tendency to gangrene is but too often the first circumstance to create alarm.

But the most important part of the subject has reference to this question—namely, how far the pathological discrepancies, which I have endeavoured to point out, can influence the treatment, or whether a diffused aneurism is curable by the same operation or on the same principle as the circumscribed. This is a point of practice on which I should scarcely have imagined the existence of any doubt, and yet it is far from being determined, for daily are different methods adopted, and different opinions inculcated, by the most talented and experienced practitioners, more perhaps from a want of due consideration and arrangement of the subject than from any other cause. I find, in Mr. Hodgson's most valuable work on the arteries, the doctrine shortly laid down, that "The treatment of a diffused aneurism should be the same as that of a recently wounded artery attended with external hæmorrhage."



hage ;” and in a very modern hospital report, where a circumscribed aneurism had been burst and become diffused by pressure, “ In consultation it was determined to treat it as a wounded artery ; accordingly an incision was made along the course of the original tumour, and the artery tied above and below the wound in it.”

Now, although there can be no question that this practice is applicable to many cases of diffused aneurism, and that in the traumatic form there is only the alternative between it and amputation, yet still it should not be laid down as a rule of universal applicability, for there are some cases that may be judiciously treated by Hunter’s operation ; there are, in fact, three varieties of case connected with diffused aneurism that may require each a distinct and separate mode of treatment, and these I shall proceed briefly to examine.

Strange as it may appear, in a case of diffused aneurism, I consider the wounded and bleeding artery as a point of secondary importance in coming to a decision as to the line of practice to be adopted, the chief being the quantity of blood effused ; for if it is very great, even although mortification may not have actually taken place, yet it is quite possible the limb may be in such a condition as to render it inevitable : or supposing otherwise, and that there is so little apparent ground for this apprehension that the artery only is secured, still, if there is much blood, the probability is, that it will act as a

foreign body, or perhaps that it may putrefy—that large abscesses and profuse suppuration will result, involving the necessity of deep and extensive incisions in a limb otherwise severely injured, and that a rapidly destructive hectic would be established. A patient, in so deplorable a condition, could only be saved by an amputation that in this instance, and after such delay, must be termed secondary, and the same arguments would obtain here that have been adduced in favour of early amputation in other severe injuries. The great question then to be decided in a doubtful case is as to the possibility of preserving the limb, and it is one of fearful responsibility, for few persons would either propose it or submit to it unless symptoms of approaching mortification were actually apparent, and then it is a case of amputation in spreading gangrene, for which, until of late years, there was no warrant in surgery, and which still requires the sanction of farther experience before it will be universally approved.

In such a case every circumstance should be taken into consideration—the age, habits, strength, and constitution of the patient—the general state of the circulation, and the probability or possibility of the occurrence of secondary hæmorrhage if the artery is tied—the kind and size of the aperture in the bleeding vessel—the manner in which the diffusion occurred—whether from a wound or the rupture of a circumscribed aneurism; and the rapidity with which the diffusion has been formed in a given time. And wherever there is a doubt as to

the proper line to be pursued, that doubt should determine for an attempt to save the limb: independently of the arguments that can be adduced in every case against mutilation, except as a last resource, there is one particularly strong here in the fact of amputations for aneurism being singularly unsuccessful. The experience of one individual can be of little value, except so far as it corroborates that of others; but it may not be inappropriate to mention here, that amongst a large number of cases of amputation in spreading gangrene, I have never seen one recover where the origin of the mischief was an extensively diffused aneurism.

The next case for consideration is that in which an attempt is to be made to save the limb, and here the question for decision is whether the vessel may be tied at a distance, as in circumscribed aneurism, or whether it must be cut on and secured above and below the seat of injury: and here the quantity of blood effused must again be taken into account, as well as the presence or absence of an external wound. If there is no such wound, and the quantity of blood is not so very great as to dissipate every hope of its being absorbed, I see no reason why the Hunterian operation should not prove successful. The principle on which a cure is accomplished in diffused aneurism without a wound ought to be precisely the same as in the circumscribed, namely, the wound in the artery must be subjected to a degree of pressure sufficient to effect the obliteration of the vessel at that spot, and this should be perfected by the

coagulum in the one instance as well as in the other. This is a point of practice worthy of the deepest attention, for it is not a trifling matter to cut on an artery so circumstanced. In the first place the operation is extremely difficult: the relative anatomy of the part is entirely deranged by the pressure of the clot, and the colours of the different tissues are all identified in the one red tint of blood. The incision must be very large, the cavity is very deep, and at the bottom the parts are so confused that the artery cannot be recognised, except by relaxing the tourniquet, and allowing the blood to flow. And this enormous wound must inflame, and must suppurate—and, then what with the chance of secondary hæmorrhage, and the certainty of long confinement, wasting discharges, and protracted hectic, perhaps the best that can be expected will be the patient's recovering with a contracted, emaciated, and almost useless limb. Assuredly, every reasonable attempt ought to be made to avoid so much suffering and so much danger; and there is some authority for believing that the Hunterian operation has been practically successful. For instance, in cases of simple fracture, it may happen that a large and important vessel shall be wounded by one of the fragments: this has been held to be a case for amputation, partly from an apprehension that the presence of the blood would prevent the natural process of consolidation, but more particularly from a well-grounded fear of the consequences of an extensive infiltration throughout the limb. In the tenth number of the *Repertoire d'Anatomie et de Physiologie Pathologi-*

ques, there is a memoir by Baron Dupuytren, in which two cases are detailed, one that was under his own superintendence, in the Hotel Dieu, and the other under that of Delpech, at Montpellier, which go far to prove that the laceration of an artery by a spicula of bone may be cured by the Hunterian operation. These reports are very valuable, not in establishing one line of practice for every case, but in shewing there are cases capable of being saved by so comparatively mild a treatment.

But there is still another case, and let us suppose a limb into which a quantity of blood has been extravasated, not sufficient to cause a gangrene of the part, but still too abundant to admit a hope of its being absorbed. Here, I apprehend, the surgeon has no choice—he must cut down, turn out all the coagula he can reach, in this way getting rid of that which would be a subsequent source of irritation, and then tie the vessel above and below the aperture. He does this, however, not because there is any analogy between the diffused aneurism and an artery bleeding externally, inasmuch as there is none, but for the purpose of removing the mass of coagulum that Nature would be incapable of otherwise disposing of. Here, then, are at least three different modes of treatment for cases of diffused aneurism uncomplicated with a wound, the selection of any or either of which depends, in the first instance, on the quantity of blood effused, and the effects likely to be produced thereby; but, as has been already observed, there are so many other circumstances to be borne in



mind, such as the age, health, and strength of the patient, his previous habits, the extent of the local injury, and its other complications—that, after all, a great deal must be left to the discrimination of the surgeon. It would be impossible to sketch all the minute shades of symptom, character, and circumstance, that may determine the judicious practitioner to one line of treatment or another. There is, therefore, but one point more on which I would observe. If the diffusion has been caused by the rupture of a circumscribed sac of an idiopathic aneurism, it will be the more objectionable to cut down upon the injured spot, because there is so far presumptive evidence of the artery not being healthy in that situation, and consequently the risk of secondary hæmorrhage will be the greater; indeed, whether it is to be attributed to the insulation of the artery or not, I have observed this formidable occurrence to be extremely frequent where the vessel has been tied thus in cases of diffused aneurism.

But if, as too frequently happens, the diffused aneurism is complicated with an external wound sufficiently open and direct to permit a portion of the blood to escape, the nature of the case is at once apparent, and the mode of treatment determined and decisive. This is the traumatic aneurism; it is the case so frequently occasioned by the awkward operation of the ignorant phlebotomist, and as it demands instant succour, its nature should be accurately understood by every practitioner. Let us, then, illustrate this case by an occur-

rence unfortunately too common. A person, in attempting to bleed his patient, strikes his lancet into the artery, and, either in ignorance of what has happened, or anxious to avoid giving alarm, ties up the arm in the ordinary way, and for the moment no further attention is bestowed upon it. But in a few hours the part has swollen, the pressure of the bandage is intolerable, and he demands that something shall be done to mitigate his suffering. When the bandage is removed, the wound is found not to have united, and a coagulum is probably seen plugging it up, which loosens occasionally, and allows the escape of a considerable quantity of red and florid blood. In the mean time the diffusion throughout the limb is extending in every direction, and the hæmorrhages from the external aperture are more frequent. If this case is treated by ligature at a distance from the situation of the aneurism, although the patient may appear relieved at the moment, that relief is but delusive. The blood may coagulate, but being unsupported by any external resistance, it cannot make sufficient pressure on the orifice of the bleeding vessel. Fresh blood is carried round by the collateral circulation, and as it constantly oozes from the punctured artery, it disturbs the coagulum in the neighbourhood, and bursts out into new and repeated hæmorrhages, until the surgeon is obliged to end where he ought to have begun, by cutting down, if he has still the opportunity, directly on the injured part of the vessel, and tying it above and below the aperture. The great difference between the traumatic aneurism

and the other forms of the disease is, that in it the hæmorrhage is external as well as internal, and that the coagulum within the limb, being unsupported, may press outward through the wound more freely than inwards upon the vessel. The coagulum, therefore, is not available to the cure, and the treatment must have reference to the wounded artery alone. If the radial artery was opened and bleeding freely from the external orifice, few surgeons would think of taking up the brachial high in the arm, knowing that the inosculating branches would still supply abundance of blood to the wound; and although the pathology of traumatic aneurism is somewhat different, inasmuch as a portion of the blood lost still remains within the limb, yet the principle of treatment is the same.

This is a part of the subject on which I particularly wish not to be misunderstood, or that it should be supposed I advocate the practice of cutting down on every wounded artery and tying it up, much less that I recommend it in the case which I have adduced for illustration. I believe arteries are wounded in the operation of phlebotomy much more frequently than is imagined, and that many a patient has been thus injured without ever having been aware that he had been exposed to so imminent a peril. Here I make a strong practical distinction between the two cases—one is only hæmorrhage, the other diffused aneurism. In the former there can be no reason why compression should not be tried—the artery is healthy, its position preserved, and its condi-

tion, in every respect, favourable ; and, if properly and firmly bandaged, the wound may unite well, and the hæmorrhage be perfectly controlled. But let it be understood, that the part must be bound up according to the rules already laid down for the application of compression to a bleeding artery ; the measures that are sufficient to control the flow of blood from the vein, will not only not answer but may prove positively injurious, by lulling the patient and the surgeon into a false security, whilst the blood, escaping ever so slowly from the vessel, is insinuating itself throughout the cellular tissue of the limb, and rendering the patient's state every moment more deplorable.

Bearing in recollection, then, that a patient should not be exposed to a positive evil in order to avoid a possible risk, more particularly as persons are not bled for nothing, and the presence of febrile or inflammatory action in the system is very unfavourable to the success of an operation, I would apply pressure in the first instance, watching anxiously and sedulously against the occurrence of pain, or swelling, or any other indication of the blood becoming diffused. And if pressure in this case fails in its object, and an aneurism is to be formed, still there is a chance that it may prove circumscribed, and the case afterwards admit of treatment by the Hunterian operation. But in the actual traumatic aneurism pressure is not likely to succeed. Suppose it to be attempted, where is it to be applied ? The artery in all probability has been pushed by the effused blood out of

its position, and we know not where it is placed. And how is it to be maintained? To be of any use it must be even, firm, and unyielding, and the pain it would occasion must be absolutely intolerable—most patients would remove the bandage in despite of any warning to the contrary. Such are the objections to pressure even at an early period; but when the aneurism has become decidedly diffused, when the limb is enormously swollen, pale, and glassy, or mottled with dark patches of ecchymosed blood under the skin—when the wound is occupied by a coagulum, which, loosening every few hours, allows the frequent escape of considerable quantities of blood, there is no time for deliberation, and the patient can only be saved from impending gangrene by an operation—that operation which I have ventured to recommend.

It may possibly be objected, that in many cases of traumatic aneurism, a milder mode of treatment might be adopted, for that success has attended the application of a ligature on a distant part of the artery. I concede the point. If the obliquity of the wound, or its smallness of size, or any other circumstance connected with it, offers such obstacle to the flow of blood, that on the removal of the impulse of the heart from that part of the circulation, the external bleeding ceases, then the aneurism, immediately on the application of the ligature, loses its traumatic character, and is no longer subject to its laws: but how do I know, previous to an operation, that such is the exact nature of the case with which I have to deal? I see before me a wound, “permitting



coagulated blood to protrude, and fluid blood to trickle," can I tell that these phenomena are produced and maintained by the impulse of the heart alone, and will cease when that influence is removed? No! such knowledge is not mine, and if in the spirit of empiricism, I practice the Hunterian operation and succeed, I have just the consolation of reflecting, that I acted rightly on wrong principles, and cured my patient, by exposing him to a double and therefore an unwarrantable danger. Again, if after the ligature has been tied, a sufficient degree of pressure is applied to lay the sides of the bleeding artery together, occasion its inflammation and subsequent obliteration—in short, if external artificial pressure can be made to effect all that which the resistance of the skin, and fascia, and other superincumbent structures would have accomplished in a less injured limb—then I conceive it possible that the removal of the impulse of the heart may be followed by a cure. But how do I know that I can apply such pressure, or, being applied, that it can be borne? The requisite pressure must occasion intolerable suffering; and, as experience has proved in numerous instances, how little reliance can be placed on it, I would explain these failures by the circumstance already alluded to, that the parts are so displaced by the blood, and the condition of the limb so entirely altered, that pressure cannot be made either in the direction or to the extent desired.

## CAUSES OF FAILURE OF AN OPERATION FOR THE CURE OF ANEURISM.

Two-fold—Return of pulsation in the sac—Secondary Hæmorrhage—Two arterial trunks in the limb—Branches communicating with the sac—Ligature tied too loosely—a too free anastomatic communication—imperfect coagulation of the blood—obstruction of the venous circulation.

Hitherto I have been discussing the subject of aneurism in its most favourable character, having spoken of the external forms of the disease as being in general cureable by operation, pointed out the particular operation applicable to each variety, and endeavoured to explain on pathological principles the manner in which the cure is accomplished. I have now to reverse the picture ; to shew what is already but too well known to every one conversant with the history of surgery, that operations, even when well planned and well executed, sometimes fail ; and to unfold some of the causes which, independently of the chances and accidents that may befall any capital operation, militate particularly against this. In order, however, to render this part of the subject more easily comprehended, it will be necessary to refer back to the conditions which must be not only fulfilled, but fully and completely perfected, in order to a cure ; these are, that the blood withdrawn from the circulation should coagulate, and then come to press upon the wounded vessel in such wise as to procure its obliteration ; and it follows that if these are not performed

rightly, the object of the operation must be proportionally defeated. Thus, let it be supposed that the blood is in some unnatural or abnormal state, and has lost its tendency to coagulate—or that the blood within the sac is subjected to constant motion or other disturbance that may interfere with the process, if it does not prevent it—one important condition is by so much rendered incomplete. Or, again, let it be conceded that the blood has coagulated, but by some unfortunate circumstance the coagulum does not press upon the vessel, and then another condition is impaired: either of these accidents must delay, and may prevent, a cure—when both are combined, success is scarcely to be hoped for. This cause of failure, arising from some peculiarity of constitution, or particular locality in which the disease occurs, is wholly accidental, and fortunately of very rare occurrence. But there is another cause of failure which has a more direct reference to the operation, and which, being in reality the greatest source of danger to the patient, occasions the chief apprehension of the surgeon. It has been seen that a ligature may be applied on an artery for two distinct and different purposes—one merely to control hæmorrhage—the other to remove the impulse of the heart from a given portion of the arterial circulation. After remaining a certain period, varying according to the size of the vessel, the ligature becomes loose, and either comes away with the dressings, or can be easily withdrawn, and the wound heals up: thus the cord ought to be detached from the subclavian about the 23d day, from the carotid about the 21st from the

femoral about the 16th, and so in proportion with vessels of smaller calibre. But in a great number of cases—so great as to render the operation of tying a ligature somewhat formidable, matters do not proceed so favourably; the purposes for which the operation was performed are not answered, the cord separates prematurely, or even previous to its complete detachment blood bursts forth from the vessel, often in appalling quantity, and the hæmorrhage thus occasioned is termed by the French “consecutive,” and by us “secondary.” I shall now proceed to examine these causes of ill success, commencing with the first, the occurrence of which is always indicated by a return of pulsation into the aneurismal tumour shortly after the artery has been tied.

When pulsation is observed to return in the sac, it is quite obvious that one object of the ligature has not been *completely* attained—that blood is still propelled into it with some degree of impulse, and that some portion of it is returned back into the circulation again—in short, that the aneurism is placed in a similar state to that which existed before the operation, only not to the same extent—and in proportion to the quantity of disturbance the blood within the sac is thus made to undergo, will its coagulation, and, of course, the cure of the disease be retarded or prevented. Thus, I conceive, as the results to be apprehended from the appearance of this phenomenon are various, it is likely it may arise from different causes, some of which are known—others, perhaps, remain to be discovered. Of those which are

known, the first I would observe upon is the existence, by an irregular distribution, of two trunks in the limb, both conveying blood to the aneurismal tumour. Sir C. Bell had a case of popliteal aneurism in the Middlesex Hospital, in which, just below the origin of the profunda, the femoral artery divided into two branches of nearly equal size, which ran parallel to each other, until they arrived at the spot where the artery perforates the tendon of the triceps muscle, and there they united again. Only one of these was tied, and although the pulsation ceased for a moment, yet it soon returned, and never disappeared until the patient's death, which happened a few days afterwards from erysipelas. A preparation of a similar distribution is preserved in the museum of the Royal College of Surgeons in Dublin, and Dr. Todd states that another is to be seen in St. Bartholomew's Hospital, London; it is quite clear, that where such exists in an aneurismatic limb, the securing of one of the trunks could produce no benefit.

Another case, in which pulsation will be likely to reappear in the tumour, is where one or more large branches arise from, or otherwise communicate with, the sac. The possibility of this occurrence has been abundantly proved in internal aneurism, where it shews that the morbid condition of the vessel is dilation and not rupture or ulceration; but I am not aware that dissection has shewn it in the external form of the disease, and of course its influence in retarding or preventing a cure can be only a matter of speculation—it ought to



depend on the number, and more especially on the size, of these communicating vessels.

There is another circumstance also, which I suspect occasionally to be a cause of the return of the pulsation, although it may not ultimately compromise the success of the operation ; but I have not had an opportunity of investigating the subject by dissection, I offer the suggestion only as a conjecture—a conjecture, however, originating in observation, and, if verified, calculated to possess some practical influence. Some few years since, the femoral artery was taken up, by my friend Mr. Cusack, for popliteal aneurism. The patient was excessively restless and turbulent, and it was with the greatest difficulty the operation could be completed at all. In the course of a few hours pulsation reappeared in the tumour, and remained, for a few days, gradually dying away and becoming feebler, but the case nevertheless progressed favourably, and at little more than the usual period the ligature came away. When examined, it was evident the noose had been tied loosely ; it could easily allow a tolerably large goose-quill to pass through it. About the same time I saw a similar case, except that in this latter the noose was left large designedly, with a view that the impulse of the heart only should be removed, without absolutely preventing the passage of the blood. In this instance the appearances were very curious. When the patient's limb was bent, and the artery, as it were, relaxed, pulsation was not only evident, but tolerably strong in

the tumour ; when, on the contrary, the limb was extended, the pulsation disappeared. The noose of this ligature also separated slowly, and when removed was found to be very large. These cases have led me to believe that a neglect of drawing the cord tightly may occasion this unpleasant symptom—unpleasant, because it always alarms the young and inexperienced practitioner ; and I am moreover satisfied, that it tends to delay the separation of the ligature beyond the usual period, a circumstance which, though not essentially influencing the result of the case, ought to be avoided, as neither surgeon nor patient can be perfectly divested of anxiety until the cord has come safely away.

The next circumstance I shall advert to as producing this unpleasant symptom is of the greatest importance, and, therefore, must be dwelt on at considerable length ; it is the existence of such an extensive and free communication, by anastomoses, as will convey to the tumour, by a circuitous route, the impulse which the ligature was intended to remove. I know not how far such a communication may be established in an aneurismal limb by a preternatural increase of size in the collateral vessels—such has been spoken of by authors, but I have no evidence of its existence in any one particular case, to an extent sufficient to produce the phenomenon alluded to. However, I believe this unhappy condition obtains, with respect to aneurisms of the internal carotid in the neck, and that the free and extensive anastomoses through the vessels of the brain in

their natural and normal state, will be quite sufficient, in some instances, as in the following case, to delay the process of cure, in others, perhaps, to prevent it.

## CASE.

On the 21st of August, 1829, I performed the operation of securing the trunk of the common carotid artery of the right side, in a woman of the name of Rourke, in the Meath Hospital. As this case has been already published in detail in the fifth volume of the Dublin Hospital reports, I shall here only dwell upon the facts that bear upon the point under consideration. It was a case of aneurism of the carotid of fifteen years' duration, consequently its growth had been extremely slow, and it might be reasonably inferred that the aperture leading from the artery into the sac was very small; it was firm, hard, and solid, containing scarcely any fluid blood, and, on examining the fauces, no pulsation could be observed within. The progress of this case was attended with some unpleasant consequences, such as a return of pulsation in the tumour in four hours after the operation, and suppuration of the sac; however, eventually my patient recovered, and left the hospital on the following March to resume her former occupation as a servant. She had never been a very healthy person, and was afterwards frequently an inmate of the hospital for pectoral complaints; at length she died, on the 7th of September, 1836; and I may mention, as a singular

instance of strength of mind overcoming the prejudices so constantly met with in persons of her condition, she bequeathed her body to me, and, by permission of the Inspector of Anatomy, it was sent to the school in Park-street.

On examining the neck it was recollected that, in the course of the operation, the sternal and a large portion of the clavicular attachments of the sternomastoid muscle had been divided, yet, during the remainder of life, the patient never seemed to have experienced any inconvenience or imperfection of motion in consequence. The condition of this muscle, then, first attracted attention. At the inferior part of the neck, and for two inches above the clavicle, there was no trace of fibre remaining of the muscle, and its place was supplied by a dense and strong fascia attached to the clavicle, into the superior portion of which the remnant of the muscle was inserted. In short, the inferior part of the muscle seemed to have been converted into this fascia; on dividing it, the jugular vein and the ligamentous-like substance, into which the artery had degenerated, were exposed.

The remnant of the artery exhibited one continuous and unbroken cord from the bifurcation of the innominate to the division into internal and external carotids, so that although the vessel must have been divided by the separation of the ligature, it had united again, and the exact spot at which it had been tied could not be

ascertained. The internal carotid also was obliterated up to the spot where the ophthalmic artery was given off within the skull. In close connexion with this was the remnant of the aneurismal sac, a small, firm, fibrous tumour, of an oblong shape, and nearly of the size and form of a very large almond; it lay a little below the posterior belly of the digastric muscle, and on the lingual nerve, to which it had some connexion, but not very intimate. The external carotid was pervious, but, as compared with the vessel of the opposite side, greatly diminished in size, as were all its branches, excepting only the thyroid, which was pretty nearly of its natural dimensions. In consequence of the injection not being very perfect, the anastomoses were in general not minutely developed above the thyroid artery, but the communication between this and the branch ascending from the subclavian was extremely free, and the inoscultations of these vessels within and on the surface of the thyroid gland very numerous—much more so than between the vessels of the opposite sides of the neck.

The subclavian on the right side was at least of twice the diameter of that on the left; the vertebral was enlarged in the same proportion; and the ascending branch of the thyroid was also increased in size. The chief external communication was between the ascending and descending thyroid arteries, which seemed to be the medium by which the external carotid and its branches were supplied; the quantity of blood formerly brought to the brain by the internal carotid was afterwards fur-



nished by the vertebral, which became enlarged throughout its whole course until the formation of the basilar artery, after which the entire circulation of the brain was perfectly normal.

This dissection proves that, in this case at least, the re-appearance of the pulsation, after operation, was caused by the free and extensive anastomotic circulation through the brain, and that, too, without the slightest appreciable enlargement of the collateral vessels. The dissection was seen and examined by my colleague, Dr. Hart, now Professor of Practical Anatomy in the Royal College of Surgeons in Ireland, and the preparation remained in the Museum of the School of Medicine and Surgery, Park-street. So far then it has been shewn that the locality of the internal carotid is, by reason of the free anastomoses in the brain, unfavourable to the cure of aneurism by the usual operation, by at least delaying its progress. I have now to shew how the same influence may prevent it altogether ; but previously it may be advisable to mention the leading particulars of a case in which such an unfortunate failure actually took place.

CASE.

Matthew Markey, aged 38, of low stature, and very strong make, admitted into the Meath Hospital, on the 19th September, 1833, with a very large aneurism, occupying nearly the entire of the left side of the neck.

It extended from about three quarters of an inch above the clavicle to the mastoid process, was bounded posteriorly by the trapezius muscle, and anteriorly it pushed the larynx considerably to the right side. The entire circumference of the neck, over the most prominent part of the tumour, was fourteen inches and three quarters—from the thyroid cartilage across the tumour to the spinous process of the fourth cervical vertebra, nine inches and a quarter; from the same points the measurement on the opposite side amounted to but five inches and a half. Examined by the mouth, the appearances of the tumour were most alarming: the pulsation could be distinctly seen, and the blood almost felt under the mucous membrane: it seemed ready to give way and burst into the mouth every moment, and so remarkable and so urgent was this symptom, that on requesting my friend, Dr. Graves, then the physician in attendance on the hospital, to examine this patient, I received a note from him strongly pressing the necessity of immediate operation, lest such a catastrophe should take place. It is needless to detail the other symptoms; they were such as are usually observed, except that the tumour was very soft, the blood within it evidently fluid, and of course, the pulsation extremely violent. This peculiarity might, in some respects be explained by the history of the case.

The disease might be said to have existed but a few days. Only five weeks had elapsed since he first perceived a hard tumour like a kernel, near the angle of the jaw, perfectly moveable, without pain, and, as he

stated, without pulsation. In the course of ten or twelve days it became uneasy, but not actually painful, and he poulticed it in the expectation that it would suppurate and break; it, however, increased in size, although slowly, and occasioned a good deal of annoyance in the motions of the head. It had then become distinctly pulsatile. Only seven days before admission, while at work, and after exerting himself considerably, he was suddenly attacked with most excruciating pain darting from the tumour across the forehead and towards the vertex. He was immediately obliged to quit his employment and return home, where he discovered that the tumour had increased in size to a surprising extent, and that it pulsed with great violence. He suffered dreadfully for the next three nights, not sleeping or even being able to lay down his head. He was then attacked with hoarseness, which, amounting at times to nearly a total loss of voice, alarmed him so much as to cause him to apply at the hospital for relief, and he was admitted on the day above specified.

On the 22nd of September the operation of tying the common carotid was performed. As the space between the tumour and the clavicle was extremely limited, I made a transverse incision at the root of the neck, parallel to and above this bone, commencing internal to the superficial jugular vein, and extending forwards about two inches in length. Having thus exposed the sterno-mastoid muscle, I divided its clavicular attachment cautiously on a director, and came down on a very

strong and resisting fascia, which, having slightly torn with the forceps, I also divided on the director. The edge of the sterno-hyoideus muscle could now be distinctly seen, which, being carefully divided, I tore the sheath of the vessels, partly with the nail of the forefinger and partly with the director. The vessel was now exposed, and although the wound was deep, I could easily pass the needle round the artery, which was tied as tightly as I could draw the ligature. I experienced no inconvenience from the jugular vein, I might almost say I never saw it. I certainly saw the pneumo-gastric nerve, because I looked carefully for it; but the pleura did not rise up in the neck as I have experienced on other occasions. Altogether there was much less difficulty in the operation than might be anticipated—the patient bore it well—was but twenty minutes on the table, and walked up stairs to his ward afterwards, refusing any assistance. On the ligature being tied, the usual phenomena occurred—the pulsation ceased in the tumour—it became diminished in size—and the patient declared himself relieved from pain.

I had mentioned, in my clinical lecture on this case, that I anticipated a return of the pulsation at an early period after the operation, and the suppuration of the sac at one more remote. In the former of these expectations I was disappointed—pulsation did not return, although the tumour remained soft, and its contents evidently fluid. As to the full extent of this assertion, however, there may be some exception taken. Sir Philip

Crampton, who took a great interest in the case throughout, always said that he perceived a weak pulsatile thrill in the tumour; and, on looking at it in profile, I sometimes saw, or fancied I saw, a slight motion corresponding with the action of the heart, like that which might be exhibited by a large swelling in the immediate vicinity of an artery; but, on examining it with the hand, I never could feel a distinct pulsation; if such existed, therefore, it must have been extremely weak and indistinct.

It is unnecessary to enter minutely into the details of this case, which at first appeared to progress as favourably as could be desired. On the fifteenth day after the operation, the ligature came away with the dressings; and, on Saturday, the 20th of October, exactly four weeks after the vessel had been tied, I find the hospital report to be as follows: Patient's health is now very good—he is up all day and walks about the grounds—sleeps well during the night—has no pain or uneasiness—the discharge from the wound daily diminishing in quantity and assuming a more healthy character. But, on Monday, the 22d, matters began to assume a different aspect. He complained of pain and stiffness in the neck, with headache, furred tongue, and general constitutional derangement. The sac had begun to inflame. On Saturday, the 27th, five weeks after the operation, the pain and swelling of the neck had greatly increased—the skin tense and shining, of a deep red colour over the centre of the tumour, more faint towards its border—



the apex soft and elastic, with a distinct sense of fluctuation. He described the pain as being most excruciating, and of a hot and throbbing character—he had intense headache—foul tongue—bowels obstinately constive—pulse ninety-six, hard and full. He also suffered from constant cough, difficult respiration, and painful deglutition. The sac had suppurated, but as this was an occurrence which had frequently taken place in my experience before, I acknowledge it occasioned me little uneasiness, and I prepared to treat the case in the manner I had treated others with uniform success.

I made a free incision into the tumour with a view to discharge the matter, turn out all the coagula, and then, by applying pressure externally, seek the obliteration of the sac. The incision gave exit to a large quantity of pus mixed with florid blood, and I found I had opened into a large cavity which scarcely contained any coagulum at all. I laid down the sides of the wound, and endeavoured to apply pressure by means of compresses, retained by numerous straps of adhesive plaister. This latter indication, however, could not be accomplished. Direct pressure caused an intolerable sense of suffocation, and the consequence was, that under the moderate degree employed, the sac suppurated freely and the discharge became profuse. Still, I imagined I had no cause for apprehension beyond the wearing and wasting hectic that would probably be established; and was, therefore, surprised at being called at three o'clock in the morning of the 30th, with informa-

tion that my poor patient was bleeding profusely from the wound I had made in opening the abscess. I hastened to the hospital and found him literally bathed in blood; and notwithstanding the exertions of a most active and intelligent pupil, who was resident there at the time, he must have lost between forty and fifty ounces. The bleeding was kept under by the pressure of this gentleman's hand, but immediately on its being removed the blood spouted forth with considerable force. On examining the cavity with the aid of a very imperfect light, I discovered several streams of arterial blood passing in different directions through a broken clot at the bottom of the sac, and my first impression was that some branches opened into, and communicated with, the cavity; and as the man must have died of hæmorrhage, whilst I should be endeavouring to secure these, I determined on trying to place the patient in the same condition as if the sac had never been opened, and trusting to the pressure of the coagulated blood for the suppression of the hæmorrhage and the obliteration of the vessels. I, therefore, passed four needles through the lips of the wound, and applied the twisted suture, which held them firmly together, and effectually stopped the bleeding, and I left the patient safe for this time, but pale, weak, sunken, and evidently unable to bear the loss of more blood.

On Friday, the 2nd October, the blood burst out again, welling from the bottom of the wound profusely, but flowing without impetus. As I had now the advantage

of the assistance of my colleague, Mr. M. Collis, I determined to explore the cavity, with the view of securing the bleeding vessel or vessels, and, if possible, preventing any farther loss of blood. I opened up the full extent of my incision, and began to clear out the cavity, when the blood burst forth in a stream equally frightful and uncontrollable, flowing from a rent in the vessel that my finger could not cover. In this predicament, not a moment was to be lost. The patient had lost so much blood that a single minute would probably decide his fate. As for seeking to tie a vessel lying at the bottom of an enormous cavity, and fully at a distance of five inches from the surface, it appeared to be wholly out of the question; and the vicinity of the pneumo-gastric nerve, and the deep jugular vein, rendered a plunge of the needle, or the employment of the actual cautery equally objectionable. I had no resource but to fill this enormous cavity with compresses of sponge, which should be maintained in their places by closing the integuments over them, and this latter could only be effected by means of needles and the twisted suture. Straps of adhesive plaister were totally useless: glue spread on leather was tried and found equally inefficacious; nothing remained but to stitch the wound in the manner specified, and it certainly had the effect of perfectly restraining the hæmorrhage for the time being. However, I knew that there could be no permanent benefit derived. I knew, from the examination I was enabled to make, that the blood proceeded from the

original aneurismal rent, that the artery which was not affected by the usual processes of nature during the five weeks that intervened between the operation and suppuration of the sac would scarcely become obliterated under the pressure of the sponge, and that the needles must ulcerate the parts and cut their way out long before any permanent benefit could be achieved. Immediately on the wound being perfectly closed, the pulsation, which had disappeared, or been so weak as to be only perceptible to the most delicate touch, returned in the tumour as vividly and as violently as before the operation had been performed at all.

It would be tedious to dwell on the minute reports of this awful and melancholy case; suffice it that the patient still continued to bleed at intervals; according as a needle would separate or a compress be disturbed, blood would burst forth with greater or less violence; and, although the hæmorrhage was always promptly restrained, yet these successive losses, in conjunction with pain, loss of sleep, and extreme anxiety, reduced him so low, that he expired without a struggle on the evening of the 12th of October, having lived thirteen days from the first appearance of the bleeding. Every effort was made to procure a post-mortem examination, but in vain; and I have been left to speculation to account for the singular phenomena and unexpected results that attended this most interesting and important case. But it is not altogether without a parallel—

and, after some research, I have discovered a case which will throw some additional light on these cases of aneurism of the carotid artery.

\* On the 15th of April, 1831, Mr. Green, in St. Thomas's Hospital, tied the common carotid, for the cure of an aneurism, situated, as he believed, at the point of its division. The patient was a man advanced in life, being sixty-five years of age: the tumour had existed from the preceding Christmas, was of slow growth, and had attained only to the size of a walnut; in other respects the symptoms detailed bear a strong resemblance to those observed in the case just related. On the ligature being tightened, a manifest and instantaneous diminution of size took place in the tumour, and in the force of pulsation, which was yet distinguishable; but the patient having been carefully removed to bed, in about an hour this had ceased altogether. It is worthy of remark, that doubts were entertained by many, who carefully observed the case, as to whether the pulsation ever ceased completely.

On the twenty-fourth day the ligature separated, the noose thereof being perfect and firm, and the dressings having been applied to the wound daily. This has some exuberant granulations, not occupying more than half an inch, which have been touched with argenteum nitratum. A feeble pulsation has been constant since the

\* This case has been abridged from Dr. Johnson's *Medico-Chirurgical Review*—No. 32, April, 1832, page 520.



20th of April, the fifth day after the operation, and we are of opinion that it has latterly been more vigorous ; the tumour itself is very materially diminished, but not to the degree that, at this distance of time from the obliteration of the canal of the vessel, we should reasonably expect.

May 31.—Arterial pulsation has become more distinct in the tumour, but is yet weak. It is supposed, from the situation of the latter, at the bifurcation of the common carotid, which is favourable to such, that a communication exists in that part between the external and internal divisions.

June 14.—(Two months after the operation.) The aneurismal sac has grown larger within the last fortnight, and the pulsation remains equally, if not more, powerful.

July 28.—Patient is suffering from suppuration of the right tonsil—a diffused swelling has taken place externally upon the neck, a little below the angle of the jaw. The tonsil was opened and discharged pus freely.

September 20.—The above local symptoms subsided in due course ; but the aneurismal swelling retains the same trifling pulsation.

I have merely extracted from the printed report of the above case the points in which it bears some resem-

blance to that of my patient, and which seem to have the same reference to the locality of the disease.

It was supposed by Mr. Green to exist at the bifurcation of the carotids, a spot equally favourable with the internal itself for the return of pulsation through the medium of the cerebral circulation. The pulsation did return, and, according to the opinion of some, never disappeared totally.

About the 28th of July, symptoms occurred which might have been occasioned by the suppuration of the sac, and, at the end of five months, pulsation remained—the disease had not been cured. The case seems to hold a middle place between that of Elizabeth Rourke, in which the progress of the disease was extremely slow, and the contents of the sac nearly solid, and that of Markey, which had proceeded so very rapidly, and in which there was probably no coagulum at all. It is to be regretted that the appearances of the tumour, in relation to the mouth and pharynx, were not described, and its ultimate result not ascertained.

Here it is perfectly evident that, in all these cases of return of pulsation, one condition of the cure was inadequately fulfilled; the coagulation of the blood in some instances retarded—in others it appears to have been prevented altogether; and it is also apparent, that although this may occur to an aneurism in any situation, it is much more likely to happen when the internal

carotid is the seat of the disease, in consequence of the free anastomoses within the brain being capable of still conveying the impulse of the heart, as proved by the case of Elizabeth Rourke. I have now to direct my attention to the possible failure of another condition of cure, as exemplified in the case of Markey, which, as far as I know at present, is, and must be, peculiar to the internal carotid alone. In a limb, when the aneurismal sac becomes distended with blood after operation, the pressure exercised thereby must be directed against the injured vessel; the structures, external to and surrounding such sac, are, many of them, inelastic, all more or less resisting; they will not permit a growth or extension of the tumour in any direction towards them, and, consequently, when the sac is filled, and more particularly when its contents are solidified, it must not only press against the ruptured vessel, but compress it to an extent and degree to occasion its obliteration. But, with respect to the internal carotid, the case is vastly different. However covered with fascia, and muscle, and skin, and other resisting tissues externally, it is wholly unprotected in the direction of the pharynx; for, on making a vertical section of the head and neck, and dissecting from within outwards, I find that the internal carotid is very close to the pharynx. In its passage upwards from the bifurcation to its entrance into the skull, it obliques slightly backwards and inwards, having behind it the sympathetic nerve and first cervical ganglion, where it rests against the spine; externally it has the styloid process, the three styloid muscles, the

digastric, the mastoideus, and the different layers of fascia; a little in front it has the stylo-pharyngeus muscle; but internally, or towards the pharynx, it has nothing but the mucous membrane, the constrictor of the pharynx, some very loose cellular tissue, and the twigs of the superior laryngeal nerve; thus the aneurismal sac has ample room to grow and increase inwardly, and, consequently, the pressure it is forced to make on the opening in the vessel may be so trifling as not in any way to lead to its obliteration.

This circumstance may explain (although in Mr. Green's case it does not appear that the mouth and pharynx were ever examined,) why that case proved to be what Scarpa might have termed an imperfect cure; and why, in the case of Markey, in five weeks after the vessel was tied, and the direct force of the heart cut off, there should have been no advance whatever in the process by which the artery might be obliterated. It appears curious that the position of this vessel, with respect to the pharynx, should not have attracted more attention in the examination of aneurismal tumours; for, reasoning from the anatomy of the parts, I should be disposed to believe that the symptom of pulsation would always be more clearly observed from within. It was so in the case just related, and I have since had an opportunity of seeing it under circumstances where it might be still less expected or looked for.

A young girl, named E——— M———, was admit-

ted into the Meath Hospital, with a varicose aneurism situated at the angle of the jaw, and extending downwards a short way along the course of the external jugular vein. It became very large and prominent when pressure was made on this vessel below, so as to interrupt the current of blood ; it became then excessively painful, and exhibited the usual thrilling sensations, both to the finger and the ear ; but when looked at from the mouth, a strong and continued pulsation, together with considerable tumefaction, was visible to every eye. This disease had been produced by a stab of a scissors, inflicted seven years before, and no very decisive treatment was adopted for it in hospital ; in fact, the real nature of the lesion was not understood, and it was only matter of conjecture that a communication had been established between the external jugular vein and the internal carotid artery with the intermediate existence of a varicose aneurismal sac. The case, however, is pathologically interesting, as affording an illustration of the facility with which such tumours may grow and increase internally, or towards the mouth.

Thus it appears that some of the conditions of cure may possibly be vitiated—that, notwithstanding the interposition of a ligature between the tumour and the heart, the impulse of this latter organ may be but imperfectly or not at all removed ; and that, in a particular locality, the requisite degree of pressure is with difficulty, if at all, applied, causing the case in principle, though not in symptom, greatly to resemble the trau-



matic aneurism. We have now to inquire whether the other remaining condition, that of the coagulation of the blood, is ever imperfect or awanting.

In the case of Markey, the blood did remain in a fluid state within the sac during five weeks after the impulse of the heart had been removed. Before the artery was tied, and whilst a large current was forced into the sac, with the full strength of the heart's action, it is not difficult to conceive that such constant and violent motion might interfere with the process of coagulation; but that, after such an interval of rest, the blood, with the exception of one or two very small coagula at the bottom, should have been found perfectly fluid, was scarcely to have been expected, and must have had a very unfavourable influence on the success of the operation. Yet such was the case, and it is no easy matter to explain why it should have been so. But the difficulty of solution attendant on this question leads me to propose another. Is there a pathological difference in the blood of different individuals, giving to that of one a greater or less tendency or disposition to coagulate than to that of another? If there is such a difference of condition or constitution, a knowledge of the fact, and more particularly of the causes or circumstances that lead to its production, might prove of incalculable benefit in the management of diseases in general, but more particularly those of the circulating system. And that there is such a difference I am strongly disposed to believe, although, being totally unprepared with satisfactory proofs, I dare

not offer it even as an hypothesis, but rather as a suggestion that may lead others, as opportunities offer, to investigate the pathology of the blood, as promising to lead to invaluable practical results. That the blood of individuals, suffering from different diseases, will exhibit different phenomena in the quickness with which the coagulum is formed, and the degree of firmness and solidity it reaches, no one will be disposed to deny; but the point to which I wish to direct attention is, that the blood of a person, apparently in a healthy state, may not coagulate under circumstances wherein that of another individual would almost certainly do so.

Some years ago, a man was admitted into the Meath Hospital, having received a stab of a sharp-pointed shoemaker's knife, about an inch below the right sternoclavicular articulation, by which the internal mammary artery and vein were wounded. These vessels poured out their blood continually, and in such abundance, into the cavity of the pleura, that the lung became dreadfully oppressed, and it was deemed advisable to perform the operation of paracentesis, on the fourth or fifth day after the receipt of the injury. The wound made in the operation was large, in the expectation that it might facilitate the escape of any coagulum, but the precaution was found to have been unnecessary, as the blood had remained in a perfectly fluid state, and flowed away with great facility. The quantity of blood thus lost was enormous, it must have amounted to some quarts, and as the wounded vessels still continued to

bleed, it is scarcely necessary to add, that the patient soon died. On examination after death, a good deal of fluid blood was found in the cavity of the pleura, but not a particle in a state of coagulation. Is it not reasonable to conclude, that in this case there was some peculiar condition of the blood that rendered it incapable of coagulation? and might not this have been one cause of the continued and unceasing hæmorrhage, without the slightest effort on the part of nature to arrest it?

On the 5th of August, a man, named James Wilson, was admitted into the Meath Hospital, with an enormous aortic aneurism.

Three months previously, he had perceived a tumour of the size of a hazel nut above the clavicle, and close to the sternum, which tumour increased in size daily, enlarging from below upwards; on admission, it occupied the anterior and right side of the neck, extending as high as the thyroid cartilage, and slightly displacing the larynx. It pulsated violently. From the symptoms, the history of the case, and careful stethoscopic examination, it was decided that it was an aneurism of the aorta, and that palliative measures only should be adopted. He remained in hospital until the 8th of September, when the tumour burst, and the patient died in a few seconds, with an awful gush of blood.

*Post-mortem examination.*—On looking at the situation occupied by the tumour during life, it appeared to have

shrunk and collapsed, and, instead of being elevated, there was a very large cavity, in the centre of which was a dark spot, marking the place at which it had given way. The sac was eight inches in its long diameter, by five in the transverse at its widest part, and sprung from the aorta at the root of the innominate, passing up behind the clavicle, which was in part carious. Not a particle of lymph, or fibrine, or coagulum of any description, existed in the cavity of this immense sac, although upwards of four months had elapsed since the commencement of the disease, and the tumour had not increased with any extraordinary rapidity.

There still remains one condition more to be noticed, in which pulsation has been observed to return in the tumour after a ligature has been applied on the arterial trunk, namely, where it appears in consequence of, or, at least, in connexion with, inflammation of the leading vein. It is perhaps, not easy to place these occurrences, in the relation of cause and effect, in the clear light of demonstration; neither is it of much importance, in the study of aneurism, for, when this calamitous accident takes place, the condition of the sac will form but a secondary consideration; still, the observation is new, and may be interesting in a physiological point of view. The peculiarity of the phenomenon in this case is, that it occurs after the inflammation has been established, that is, at a much later period than when produced by any of the preceding causes; that it increases in intensity along with it; and

that examination after death exhibits no explanation of it except the one advanced. I apprehend the cause of it to be shortly this, that blood does not circulate through the inflamed vein—that congestion, consequently, occurs in the minor branches and capillaries—and that, as a result of the resistance thus offered to the circulation, a reflex action is produced in the arteries, just as in a case of congestion from inflammation or any other cause. The effect of any impediment to the circulation is well understood, and, when artificially produced in our operations and experiments, is easily observed. Thus, when an artery is laid bare, it lies like a tremulous cord under the finger, its pulsations weak, indistinct, and scarcely to be felt ; but, the moment a ligature is placed upon it, the portion next the heart seems to work and struggle to break through the barrier, bounding and beating so forcibly as to be visible to even a distant spectator. Again, in experimenting on animals, if we open the breast of a rabbit, and wait some time until the circulation appears to have totally ceased, and the thin transparent aorta looks like an empty and flaccid vessel, and, if we then apply a ligature around it, the part above the cord will be seen to pulsate with a degree of strength that, under the circumstances, seems surprising. But (as I have said) the effect of any obstruction to the circulation is easily understood, and the only question in the present case is, whether the inflamed condition of the vein is sufficient to produce it. On this point there will, probably, be a difference of opinion, for I know several who not only think that blood may



circulate through a vein so circumstanced, but that pus may there become mixed with it, and so pass into the general circulation ; and, perhaps, in some instances, it may be so—but, unquestionably, not in all, as may be proved by the following case.

On the 4th July, 1840, in the operation of securing the femoral artery for the cure of a popliteal aneurism, the vein was unfortunately pricked, and a small portion of it included in the ligature along with the artery. The case progressed pretty nearly as all such cases do, as unfavourably as possible, and the patient died, on the fifteenth day after the operation, of inflammation of the vein and its consequences. It is not my intention here to dwell on the symptoms of this interesting and important case, because I shall have occasion to refer more at large to it and some others hereafter, when discussing the results of this particular operation ; it will be sufficient to state, that pulsation reappeared in the sac on the 10th day, and gradually increased in violence until the man began to sink a few hours before his death.

On dissection, the vein was found extensively inflamed, but the inflammation had passed more freely down the limb, where it extended even beyond the popliteal space, than upwards, for it was limited in that direction at the groin. The vessel appeared enlarged—its coats thickened and solidified—on being slit open, the lining membrane seemed to be in a state of slough—it was of a muddy brown colour and bathed in a quantity of foul

and fetid sanies. Masses of soft broken lymph were seen filling up the entire of the canal in several places, but there was no clot of blood, nor any discoloration of the lymph, to indicate that it had been in contact with blood since the time of its formation. Placed in connexion with the œdema of the limb, the enlargement of the superficial veins and other symptoms that occurred during life to indicate an obstructed circulation, it was the opinion of those who examined the limb with me, that blood had not circulated in the vein from the time it became inflamed.

## SECONDARY HÆMORRHAGE.

**Definition**—Two kinds of Consecutive Hæmorrhage—One occurring at an early period—**Symptoms**—**Results**—**Supposed Causes**—**Treatment**—**Tying the Artery higher up**—**Pressure**—**Consecutive Hæmorrhage at a late period.**

I wish it was in my power to continue the discussion of the surgical treatment of aneurism in the manner I have hitherto endeavoured to conduct it—that when stating a symptom, or suggesting a remedial measure, I might explain the occurrence of the one, or propose some principle to sustain the other—and that I might still in every practical proposition be authorised to place it in connexion with some leading pathological fact; but I am now compelled to abandon a course so pleasing and so profitable; and, whilst bringing under consideration some of the most difficult and formidable cases ever

submitted to the surgeon's care, can only state that certain symptoms have been observed, and certain practice adopted, but without subjecting either to any thing approaching to a scientific arrangement. It has been already stated that, after the application of a ligature on an artery for either of the purposes for which it is used in surgery, it is yet possible, at a period more or less remote, for the vessel to bleed again, and give rise to that unmanageable affection, termed consecutive or secondary hæmorrhage; but, however humiliating the confession, I must acknowledge that the causes which may thus render an operation nugatory in one individual that shall be perfectly successful in another, are as yet almost completely involved in obscurity. In general, they have been regarded as purely local, and when the occurrence takes place we are accustomed to look back for some accidental mistake or oversight in the performance of the operation, in order to account for it; and if such was really the source of the mischief, we have what is infinitely better, numberless rules laid down and precautions insisted on in order to avoid it. But I know not how far we are warranted in attributing it to any such cause. Assuredly, by this time, and with so much experience, we ought to have discovered every necessary step, and have arrived at such a degree of perfection in adopting each, that secondary hæmorrhage, if in any way depending on the surgeon's hand, ought to be no longer known: but it cannot have escaped the observation of every practitioner, that some of the most bungling and clumsy operations ever performed were crowned

with success—that some of the most unpromising cases have been singularly fortunate—whilst the very best and most dexterous operators, and the most judicious in the selection and the preparation of their cases, have been absolutely harassed by the frequent occurrence of this distressing symptom. Is there not some reason then for saying that its cause is as yet unknown, and for hazarding a conjecture that it depends much more on the constitution of the individual than on any local circumstance whatever? But we shall have to examine into every particular connected with the subject more minutely as we proceed.

And first, let us endeavour to attach some definite meaning to the term “consecutive or secondary hæmorrhage,” for in some instances it seems to have been vaguely applied, and in others, perhaps, it may not appear to be perfectly correct. Practically, we meet with it under two conditions—one, where there has been previous bleeding, which, being controlled for some time, bursts forth again: thus, if a bleeding vessel that had been tied, or a surface to which the cautery had been applied, should bleed, or even if a hæmorrhage that had seemed to have been stopped by the sanative powers of Nature alone, should appear again, this bleeding is termed secondary. The other, where there has *not* been previous bleeding, but where a ligature or some other form of compression has been applied to an artery, in order to the cure of an aneurism situated in some distant part.

Now, in the first of these, all the cases of bleeding that occur at a very early period should be termed "primary." If a ligature has been loosely and imperfectly applied, and slips from its hold on the vessel—if a patient has been put to bed after an operation without all the wounded arteries being secured—if compression has been resorted to, and the bandage or other contrivance has yielded—or if the cautery has been applied sparingly and insufficiently, there is as little reason for considering the hæmorrhage as secondary, as there is for compassionating the surgeon, to whose *insouciance* the accident is attributable. In these cases the vessels are generally healthy, and would have run their proper course to obliteration if they had been properly managed, and, indeed, we often see Nature make wonderful and successful efforts where art cannot be made available.

A boy, attempting some improper liberties with a female servant, was struck by her with a knife in the superior part of the thigh, and the profunda artery wounded: the bleeding was immediately controlled, but, after nine days, burst out again, welling forth without impetus, and coming from the inferior section of the artery. Pressure was applied, but inefficiently, for in a little time he bled again, and, after several recurrences of hæmorrhage, he was reduced to so deplorable a condition that something more effectual should be done. The application of a ligature on the bleeding vessel was out of the question, for, lying deep on the bottom of a granulating wound, its mouth could not be discovered:



he was placed on the table, in order to have the iliac artery tied, when some person remarked that he had not bled since the previous evening—he was replaced in bed and never bled afterwards.

Indeed, where a ligature had been tied, the accident of early bleeding is almost always the consequence of some fault in the operation; the ligature may have been tied too loosely, or some of the adjacent structures included, or it may have been composed of some improper material so as to spoil or rot. It is a rare occurrence, at the present day, to see a ligature become loose, since it has been known not only that the internal and middle coats may be divided with impunity, but that it is really better they should be so: however, that danger did once exist from this cause may be inferred from the anxiety formerly evinced to fix the ligature firmly, and the contrivances adopted for this purpose. It occurred, I believe, to Sir A. Cooper, to see the ligatures come from both segments of a divided artery immediately after their application, apparently forced off by the strength of the circulation, and many cases are on record of arteries bleeding on the second, third, and fourth days; but, it must be remarked, that these cases were where the artery had been wounded, or where, for the cure of aneurism, two ligatures had been tied and the vessel divided between them.

I cannot find a satisfactory instance of very early secondary hæmorrhage from the application of a single

ligature, as in a case of aneurism ; yet, in order to prevent this accident, it has been recommended to pass the needle round the vessel between its cellular and fibrous coats, on the supposition that the cellular coat would thus become a support for it and prevent its slipping. I know not whether this very nice operation could be performed, but, certainly, if it could, it would be one of the very best methods of producing the hæmorrhage it was intended to prevent. Another plan was to pass a ligature through the artery, in order to support and retain that one which surrounded it. But it is a waste of time to dwell on such absurdities ; they belong to a by-gone day, and are now thrown aside ; and we feel confident that there is little or no danger of a ligature yielding or slipping, if it is composed of proper material and firmly tied on the vessel, without the intervention of any other substance.

The second form of consecutive hæmorrhage may be again subdivided into two classes essentially differing from each other in their origin, progress, and terminations, one occurring at a period near to, but somewhat earlier than, the time the ligature ought naturally and healthily to come away—the other, at a much later period, when the cord has been long separated, and, perhaps, a reasonable degree of confidence might have been entertained that the patient had surmounted every danger. The first of these is by far the most frequent of occurrence, and, as it rarely ends favourably, has always been a source of apprehension to the operating

surgeon ; it is, therefore, of the greatest importance to be familiar with the symptoms preceding and attending it. In some instances, the practitioner receives ample warning of the coming event, by the appearance of febrile symptoms—a full throbbing pulse—great heat of skin—flushing of the countenance—headache—restlessness—incontrollable anxiety—and a peculiar sensation of tightness about the chest. The patient himself is occasionally conscious that the vessel is about to give way, and I have known more than one entreat to be bled, in the hope of mitigating that oppressive sense of tension. But, perhaps, this is rather the exception than the rule, and, far more frequently, the secondary hæmorrhage comes on without such previous notice, and the patient, on suddenly turning in the bed, or using some exertion equally trivial, finds the blood oozing forth from the place where the ligature had been tied. At this time the artery has been completely divided by the cord, which has, probably, come away ; but I have seen the blood flowing from the inferior segment, whilst the ligature was still firm and fixed upon the upper. It is always the inferior portion that bleeds, just as has already been seen in the case of an artery divided by a cutting instrument. At first but a small quantity of blood is lost, seldom more than four or five ounces ; it does not flow *per saltum*, but wells up from the bottom of the wound. This may cease spontaneously, or yield to steady and gentle pressure, although either occurrence is very unlikely ; but, if not effectually

controlled, in each succeeding hæmorrhage the loss of blood is more abundant.

Under such circumstances, hæmorrhagic fever, with its periodical exacerbations, is soon established. The patient, when unexcited, lies pale and exsanguine, yet, at the same time, excessively irritable and anxious; but, whilst under the influence of the febrile paroxysm, his face is flushed, his skin hot and dry, his pulse tight and bounding, but affording a peculiar sensation resembling a double beat, and it is during a period of such exacerbation that each successive hæmorrhage occurs. When once established, few cases can be more unfortunate or more unmanageable than secondary hæmorrhage; for, although few patients die of the actual loss of blood, yet, either the extensive and successive bleedings, or the means it may be necessary to have recourse to in order to control them, or the wretched state of constitution that predisposed to the disease, and is daily aggravated by its continuance, each or all of these may lay the foundation for future ills, under the infliction of which existence can be scarcely considered as a boon.

Thus, I say, a patient may recover from the immediate or pressing danger; there have been several cases in the Meath Hospital thus fortunately managed, if fortunate it can be called, for in some mortification took place, probably induced by pressure on the vein, and

one of these was only saved by amputation performed while the gangrene was still spreading. Others, again, at a more remote period, suffer from abscess, ulceration, periostitis, caries, mortification, and a host of other maladies involving the loss either of limb or of life. I have never seen a case of secondary hæmorrhage from the femoral artery that there was not erysipelatous inflammation and abscess on the outside of the thigh near the great trochanter. Unquestionably, it is not always easy to connect these accidents with the consecutive hæmorrhage by accurate pathological reasoning; but they occur too constantly to admit any doubt of their relation. We now proceed with the investigation of the received pathology of this affection and its supposed exciting causes.

When the process, already described as following the application of a ligature on a vessel, goes forward healthily, and the cord comes away at the regular and ordinary period, it is supposed that the inflammation produced by it on the artery is of a mild and mitigated nature, that does not proceed farther in its effects than the effusion of coagulating lymph: whereas, in the cases of secondary hæmorrhage, the inflammation is of a more excited and aggravated character, the result of which is ulceration. According to this view of the subject, every thing that could by possibility tend to occasion ulceration was supposed to be a directly exciting cause of secondary hæmorrhage: amongst which the separation of the vessel from its connexions, and the state of tension



in which it is placed by having a cord tied round it. occupy the most prominent situations. Now, in order to understand this position, and it is one which I am by no means disposed to deny, it must be borne in recollection that, as inflammation exhibits various characters, and tends to various results in other structures, there can be no reason why it should not do so in an artery as in the rest; and we evidently see at least two varieties, one producing an effusion of coagulating lymph, tending to the obliteration of the vessel, and thus, instead of injury, ministering to the safety of the individual; the other, occasioning an alteration in the appearance of the arterial structures, the deposition of an unorganised steatomatous substance in them, and finally leading to ulceration. The former of these may not be unaptly termed the healthy inflammation, and is generally the sequela of accident or injury—the other, the unhealthy, is, as may be anticipated, more frequently idiopathic. Let us now only hold in view that the unhealthy inflammation has no tendency to the secretion of lymph or the formation of adhesions, and we have some clue to the pathology of secondary hæmorrhage. When an artery is tied, the internal and middle coats are mechanically divided, and there is nothing to retain the ligature on the vessel but the portion of cellular tissue contained within its noose: this tissue is deprived of vitality, and must be separated by the absorbents removing the adjacent sound membrane that connects it with the rest of the tunic. If the healthy inflammation has been established previous to this process, adhesions have been

formed, and there is no bleeding—if the unhealthy, not a particle of lymph has been thrown out, and there is no obstacle to the flow of blood. The most curious part of the question is, why these two forms of inflammation should occur in the same individual; yet, experience proves that secondary hæmorrhage only takes place from the segment below the ligature, and I have verified by dissection the fact that a different kind of inflammation takes place at the cardiac and the distal side of the cord. A man died on the sixteenth day after the operation for popliteal aneurism, and whilst the ligature still remained undetached from the artery. The vessel was carefully removed from the body, and on being slit up, the lining membrane of the portion at the cardiac side of the ligature was of a pale yellow colour, and nearly of its natural appearance, with the exception of one or two broad spots of a very light pink colour. A large coagulum extended upwards from the seat of the ligature, the base of which was attached to the lymph situated there. The ligature was still firm, but on attempting to tear it away, the lower portion of the vessel easily separated from it, leaving it still firmly fixed on the upper section—a circumstance that explained a fact I had frequently witnessed, that of secondary hæmorrhage occurring before the final separation of the cord. *Below* the spot where it had been tied, the vessel appeared to be of a deep pink colour, approaching to carmine, the seat of which colouring matter was in the cellular tissue, between the fibrous and internal coats. This cellular substance seemed to be hypertro-

phied and largely congested with blood, while it caused the lining membrane to be thrown into transverse rugæ, or folds. On pulling off the membrane, it was pale, transparent, and colourless—devoid of proper vascularity; and, on looking along the slit side of the vessel, the fibrous coat and the internal membrane were seen like white lines, with the congested cellular tissue between them. There was not a particle of coagulum, either of blood or lymph, in any portion of the vessel below the ligature.

I assume now that the occasional existence of this *unhealthy* inflammation will be conceded; let us see how far the denudation of the vessel can be admitted as its exciting cause. It has been already observed that some of the most clumsily performed operations have had the best success, and *vice versa*—a circumstance that could not happen if the denudation of the vessel was of such extraordinary consequence. Again, in considering the subject pathologically, we find that ulceration is not a diseased process to which the arterial structure is prone, except when it occurs internally, and as a sequela to the inflammation and steatomatous deposit already so extensively noticed. An artery will lie perfectly denuded and white at the bottom of a phagedenic ulcer in the groin for days, before it gives way and bleeds; and when it does, it is not by ulceration, but by the formation of a slough, on the separation of which the blood bursts forth rapidly, and in a manner totally different from the phenomena of secondary hæmorrhage. Lastly, if this

denudation was to have any injurious effect, it should be by cutting off the vascular supply from which the vessel derived its nutriment, and the consequence of that ought to be sloughing, and not ulceration ; and, in either case, both sections of the artery should suffer alike, whilst it is known that the bleeding always comes from the inferior. Moreover, although experiments on animals cannot have any decisive importance attached to them, yet they may be noticed when they bear remarkably on any particular point. Haller and John Hunter, Sir E. Home, and, in this country, Sir P. Crampton, dissected off the external and fibrous coats of arteries with a view to ascertain whether aneurism could be produced by a protrusion or hernia of the internal one. In such an experiment, this membrane must have been deprived of all connexion with adjacent parts, and cut off from all vascular supplies. Why did it not die and slough away ?—at all events, why did it not ulcerate, if this pathological explanation of secondary hæmorrhage be the true and correct one ? The answer is simple and plain—because, in order to this result, a particular kind of inflammation must be established in the vessel, of which the artery of an animal is not susceptible, and which, although it may occur in man, is certainly not produced by the denudation so much spoken of and relied on. In these pathological observations let me not be misunderstood as advocating careless or clumsy operations ; for, if operating myself, I should not wish to expose more of the vessel than would barely permit of the passage of the ligature around it ; but I cannot,



at the same time, shut my eyes to the truth, and admit as the solution of a phenomenon a fact so obviously insufficient.

It was the same apprehension of the effects of stripping an artery from its connexions, together with the idea that the application of the ligature placed it in an unfavourable state of tension, that led the late Mr. Abernethy to propose a different mode of operating. He observed that the arteries tied on the face of a stump seldom bled, which he attributed to their being allowed to retract within the adjacent structures, and thus preserve their natural attachments undisturbed; he therefore advised, that the artery should be tied with two ligatures, and divided between them, the sections being thus permitted to retract. What could be done more entirely calculated to avoid these influences than this operation? and yet, when we test it by the results of experience, we find it valueless; for it cannot be questioned, and the observation is supported by the authority of Dupuytren, that as many cases of consecutive hæmorrhage follow this mode of operating as any other; if permitted to speak from my own experience, I would say—more. Here, then, both the ligatures are placed as remotely as possible from each other—no part of the vessel is denuded or disturbed except the intercept between them—and, when this is divided, both the segments remain in perfect contact with their natural connexions, as completely nourished as before the operation; and, if the hæmorrhage occurs amid all these favour-



able circumstances, it forms the strongest argument against those who imagine the disturbance of the artery to be its cause.

Another cause that has been adduced as leading to secondary hæmorrhage is, the circumstance of the ligature having been applied near to a collateral branch, because, in such case, there can be no internal coagulum formed, and a part of the natural process must be incomplete. It has been already stated, that more importance seemed to have been attached to this early coagulum than it deserved; and, indeed, I cannot see how it can have any influence on an artery at so late a period as when the ligature is about to separate; but the best observation on this subject may be derived from experience. I have tied the common carotid, within an eighth of an inch of its origin from the innominata, with the most complete success: and yet, if there is one spot in the body where this cause of secondary hæmorrhage should operate with decided effect, it is here. This theory must, therefore, be dismissed as insufficient also.

Thus far I have endeavoured to prove that the causes of consecutive hæmorrhage hitherto advanced are unequal to its explanation; but, in thus pulling down an old and faulty edifice, I do not find it equally easy to construct a new one; the fact being that its real causes are involved in great obscurity, and that morbid anatomy has, as yet, afforded but little assistance in the investigation. True it is, that the immediate death of

a patient from secondary hæmorrhage is by no means common, and, therefore, the *exact condition of the vessel, at the moment the blood burst forth*, may not be easily ascertained; and whilst, by pressure or by any other of the modes of treatment generally resorted to, such alterations may take place in the artery as to throw an air of doubt and incertitude over its original condition, yet, still, allowances might be made for these influences, and some points established in the investigation that might be advantageously followed up. So far as we have gone it seems to be nearly proved that, in a divided artery, a different process is set up in the two segments as preparatory to secondary hæmorrhage—that the superior one inflames *healthily*, lymph is effused, and the orifice obliterated—and that the inferior inflames *unhealthily*, lymph is not effused, the vessel remains open, and allows of the escape of the blood; the next, and the really valuable point to determine, is as to the cause which gives a tendency to this unhealthy inflammation in one individual more than another. The opinion of any one practitioner can be of but little value; yet, judging from my own observation, and few persons have watched these cases with a more devoted attention, I feel convinced that secondary hæmorrhage arises from some weakness, some vice, some insufficiency in the constitution, although I cannot form even a plausible guess at what the nature of that abnormal condition may be. I cannot tell beforehand what case is, in this respect, favourable to operation, and what is not; and I have repeatedly seen the most experienced practitioners

mistaken in their prognostics. Often have I imagined that the same causes which give a tendency to the formation of aneurism lead also to the production of secondary hæmorrhage; that the peculiarity of constitution is the same, and the kind of inflammation similar in both cases; and this conjecture is borne out by observing how infrequent the occurrence is after an artery being tied in consequence of wound, when compared with the results of the ligature for aneurism. This opinion is also favoured by the unmanageability of the affection, as if this form of inflammation lay beyond the resources of surgery, for, even when I see secondary hæmorrhage threatened, I cannot always prevent it: an excited circulation may be brought down—an exacerbation of fever may be mitigated—but these will offer no certain guarantee against the occurrence of the bleeding. In very numerous instances the surgeon has no intimation of the mischief until the blood makes its appearance, nor can he ever be certain of his case until the ligature has come away, and the wound is either healed or in rapid progress of becoming so.

But, when the blood has burst forth, let us see if art possesses any resources, and examine why it is that this form of hæmorrhage is so much more dangerous than any other. At first sight it seems to be a case of simple bleeding, exactly, so far as the artery is concerned, as if it had been cut across with a knife, the superior section tied, and the inferior left to bleed; but, by this time we have learned that there is something more to

be dreaded in a depraved constitution and an unhealthy artery ; and the great and practical difference between primary and secondary hæmorrhage is, that in the primary, if the temporary means of arresting it succeed, the permanent will be, in due time, completed also ; but, in the secondary, however for a time the flow of blood may be checked, the artery is not in a condition to accomplish the permanent cure afterwards. Nevertheless, however hopeless the case may appear, when considered pathologically, it is certain that some patients have recovered, and, therefore, it is our duty to use our best exertions ; and I think the case ought to be treated in the same manner, and on the same principles, as ordinary hæmorrhage, namely, the vessel must be subjected to the degree of pressure which would in such case cause its obliteration. Here the ligature is inadmissible, because, in the confusion of parts, it would be difficult, if not impossible, to find the artery, but more particularly, because that line of practice had already been tried and failed. There appears then to be no resource but the application of mechanical pressure by some other method, and if this does not accomplish the desired purpose, and the limb cannot be removed, the patient's chance of life is but small indeed. Holding this simple view of the subject, it can be easily understood how many patients have been lost by treatment founded on erroneous principles, or rather no principle at all.

Nothing had been more usual hitherto than to treat

secondary hæmorrhage by tying the trunk of the artery higher up or nearer to the heart ; nay, within a comparatively short time, I have not only heard it proposed but seen it practised. I will not dwell for a moment on the unreasonable nature of such practice, as long as there is a collateral circulation to convey blood to the open vessel, but merely inquire if the superior segment is closed and blocked up with lymph, or if, as I have before noticed, the ligature still remains upon it, whilst the lower had separated and was bleeding, of what possible utility could the tying of the artery higher up prove ? It could only remove the impulse of the heart from the superior section, from which no danger is to be apprehended, but could have no influence on the lower, already deprived of that impulse, and supplied only by the collateral branches. If the operation, then, be useless, that would alone be a sufficient argument against subjecting an unfortunate patient to additional suffering and misery ; but it is decidedly and positively injurious, and constantly aggravates his condition. I say “ constantly,” because, although a few solitary patients may have recovered after, or, more correctly, in despite of the operation, yet the numbers are so small as scarcely to constitute an exception to a general rule. It seems to act prejudicially in two ways ; one, by a fresh secondary hæmorrhage from the newly-tied artery, and the other, by inducing gangrene.

On a *prima facie* view of the subject, it would be only natural to suppose that where the ligature of the



femoral artery is followed by secondary hæmorrhage, the same causes operating in the same individual would occasion the same result if the iliac was secured afterwards. Such is really the case, but with this difference, that the hæmorrhage from the second ligature always appears at an earlier period than that from the first. Some years since, I had an opportunity of seeing this fact fatally exemplified, in a man who was the subject of operation for popliteal aneurism. In this case no ligature was used; but the artery, having been laid bare, was compressed with Deschamp's instrument; yet, in due course of time secondary hæmorrhage made its appearance—the artery bled on the eleventh day. There was space for securing the vessel higher up on the thigh, which was accordingly done; the ligature here separated, and the bleeding occurred on the sixth day. The external iliac was then tied, but it bled on the third day. As a last resource, the thigh was amputated, although I never could learn what benefit was expected from this operation, and the patient died upon the table. In these remarks, relative to the second ligature of arteries, I am again borne out by the high authority of Dupuytren, who observes, that in these cases the cellular tissue of the artery becomes inflamed and hard, that it breaks down under the ligature, and, being thus incapable of retaining it, allows of its premature separation.

When, as is sometimes the case, the second ligature is not followed by hæmorrhage, it is by no means a

necessary consequence that the patient is safe, it not unfrequently happening that gangrene occurs either at the wound, or in some other part of the limb. I cannot explain the pathology of this untoward event to my own satisfaction. It may be that the pressure necessary to control the hæmorrhage (for this pressure is always indispensable, notwithstanding the second ligature) operates also on the vein, prevents the return of the blood, and thus induces mortification. It may be that the second ligature acts prejudicially, by throwing the circulation and nutrition of the limb on collateral branches not able to sustain it. Thus, for illustration, when the femoral artery is tied, the whole circulation of the thigh, leg, and foot is thrown on the branches of the profunda, which become proportionally enlarged in order to convey it. This enlargement, as is seen under other similar circumstances, is probably accompanied by a loss of elasticity and tone in these vessels; but, as the blood within them receives an impulse from the heart, it is still propelled forwards, and the limb well nourished. But if the iliac be tied afterwards, the circulation is then thrown on a new set of vessels, the branches of the internal iliac, which convey the blood into those debilitated branches of the profunda, now injured in tone and deprived of the assistance of the heart's impulse. I know not how far this supposition can be made available in explaining the occurrence of mortification; but it appears evident to me, that the collaterals of such a limb must be in a very unfavourable condition for maintaining its circulation.

Having thus shortly noticed the proposal of tying the artery higher up, I return to the treatment of the case. On the appearance of the blood, the wound should be opened up, the granulations broken, and the mouth of the bleeding vessel fairly exposed; on it a small piece of prepared sponge should be placed deep in the bottom of the wound, care being taken that the pressure should be confined to this one spot—on this a small compress of lint, and another, and another, successively, until the graduated compress shall have attained a level higher than the adjacent surface of the limb. This must be firmly retained without being permitted to slip, and without allowing the escape of a single drop of blood; and, if this can be accomplished for three or four days, there is every reasonable probability of success. But here is the great difficulty. It is scarcely possible to apply a bandage, so as to answer the purpose, without interfering with the venous circulation and occasioning great pain; and as all bandages stretch and slip, and become relaxed, no certain reliance can be placed on them in a case where the patient's feelings encourage him to disturb them.

Now, let us suppose this pressure applied and maintained in the best possible manner—suppose a number of assistants relieving each other in keeping up a continued manual pressure, and regulating both the quantity and direction of it to the extent that might be necessary, and no more, still is the case unpromising: for the artery is seldom in a condition to effect those changes

necessary to the permanent suppression of the bleeding, and although some few recover, yet is the chance against any given case exceeding great. For the management of one of these cases Sir P. Crampton contrived a kind of tourniquet, which has hitherto proved useful, and, probably, will be successful where success is possible. It consists of a plate on which the back of the thigh rests, to which is attached an iron hoop-ring; in the front of this ring a screw is placed, which, acting on a plate underneath, makes direct pressure on the graduated compress, whilst the hoop protects every other part of the circumference of the limb. By means of this instrument two cases were treated in the Meath Hospital with the most remarkable success, and some others, I believe, in Dr. Stevens'; it may be removed if the bleeding continues subdued for a few days; but the sponge at the bottom of the wound should be left to be detached by suppuration.

It is encouraging thus to be able to adduce any instances of patients being saved from the consequences of an accident hitherto so fatal; but severe were the terms of their recoveries, and the penalties they had to pay for their existence. In all the cases of so-called recovery, abscesses formed in the superior and external parts of the thigh, pending the pressure or immediately after its removal; in one of them the wound became sloughy, and fears were entertained that it would be necessary to discontinue the pressure. The first on whom it was tried seemed to recover well, but, in a

short time afterwards, was attacked with abscesses, disease of the knee-joint, periostitis, and finally the limb was amputated for spreading gangrene. As I stated already, I am certainly unable to connect these occurrences with the secondary hæmorrhages in the pathological relations of cause and effect, but having observed them so frequently, am bound to regard them as something more than casual coincidences, nor do I regret repeating these facts if they have the effect of shewing how little is known of secondary hæmorrhage, and how worthy the subject is of future investigation. Neither let it be supposed, even on the authority of these recoveries, that a similar expectation is to be entertained in every case, or that this instrument is invariably to prove successful.

Since the cases just noticed, I have seen two patients die, and when all the circumstances are considered, the only matter for surprise is, that any should recover at all. Sometimes the patient complains of intolerable pain from the pressure, the limb becomes œdematous, and gangrene supervenes—sometimes the part of the thigh immediately around the wound is seized with erysipelas, which spreads in every direction, notwithstanding the removal of the pressure—sometimes the edges of the wound become livid, dark purple, or black, and gangrene commences there. In all and every of these cases the constitution is deeply and dangerously engaged. No case of secondary hæmorrhage can occur without great anxiety and excitement of mind, accompanied by the



debility which is the natural consequence of repeated losses of blood. This combination produces an irritative fever of the worst kind, exhibiting symptoms of nearly typhoid depression: a system thus deranged is very unlikely to make any successful rally; and if the conjecture I have hazarded be correct, that the diseased condition of the artery depended on constitutional rather than on local causes, it will follow, that the difficulty of managing the accident, and most of the unhappy results that attend it in one shape or another, arise from constitutional disturbance. Separate these from it, and it is only a case of bleeding: we can stop the blood by pressure, as in any ordinary case, but we cannot control or prevent the miserable results—results which are not observed unless where this hæmorrhagic irritative fever is present.

There is still another form of secondary hæmorrhage, more provoking in a surgical point of view, (if I may be allowed the expression,) than either of the former, because it comes on at a later period, after the ligature has been for some time separated and removed, and when both practitioner and patient might have entertained a reasonable expectation of having surmounted every danger. This, as far as I know, is a most calamitous occurrence, and scarcely admits either hope or chance of escape. Thus, when the wound remains a long time open and suppurating profusely, or when abscesses and sinuses form around the vessel, or when it lies bare and denuded at the bottom of the wound, there is danger

that it will give way and slough, just as it might do in any gangrenous or phagedenic ulcer. It is probable that to this cause the failure of Mott's case of ligature of the innominata is to be attributed. The ligature came away on the fourteenth day after the operation, and on the twenty-third day the hæmorrhage occurred, bursting forth with great violence to the extent of twenty-four ounces, and nearly destroying the patient in a moment; he died on the twenty-sixth day, and dissection shewed a large and deep ulceration around the artery, which had spread to, and engaged it, as well as the other great vessels arising from the arch of the aorta.

Mr. Abernethy had a case nearly of this description in the femoral artery, and I have seen one in the arm, where the artery was completely insulated by a sinus running along it. Fortunately these cases are not of frequent occurrence, for they scarcely admit of any remedy except the deplorable one of amputation, and if the situation of the vessel will not admit of this, I know not how life could be preserved; for it would be impossible to apply pressure on a vessel in the midst of such an open sore or abscess; and I have already shewn how very inefficacious a ligature must be when placed higher up or nearer to their heart. It is obvious that this kind of consecutive hæmorrhage must frequently owe its origin to constitutional causes, and also that the place in which the artery is situated may occasionally have some influence. Thus, as these protracted unhealthy supurations are prone to occur where there is abundance

of loose cellular texture, such as the anterior mediastinum or the axilla, perhaps there is less reason to calculate on the successful results of operations in such localities—at all events they are not the situations that would be chosen if there existed a power of selection.

## ANEURISMAL VARIX—VARICOSE ANEURISM.

Definition of these Diseases—How formed—Adhesions between an Artery and Vein—First described by Dr. William Hunter—Symptoms—Pathology—Treatment—Curious case of Varicose Aneurism—Compression—Dupuytren's objections to it—Some cases demand operation—Principle on which a cure is to be attempted.

After the general view I have endeavoured to take of the various forms of aneurism, there remains for discussion but one disease to which the name can be with propriety applied; a disease of rather infrequent occurrence, but, perhaps, not on that account the less important, lest ignorance or mistake should lead to improper treatment and its train of disastrous consequences. It differs from the affections already described in many particulars, but principally in that the blood which flows from the injured artery does not remain in the part and become coagulated, but still continues to circulate, though in an abnormal channel, and, consequently, the patient escapes all the inconveniencies and perils that, as we have already seen, arise from the growth of the tumour and the pressure thereby produced. When the trunk of an artery and that of a neighbouring vein together suffer so curious a lesion

that the blood escaping from either vessel can pass freely into the other, and become mixed in its circulating current, the disease is formed and consists of two kinds or species: one, where the orifices in the two vessels respectively lie in close contact, and the communication is immediate and direct; the other, where the communication is mediate, in consequence of the interposition of an aneurismal sac of greater or less dimensions. The former of these is termed *the aneurismal varix*—the latter, *the varicose aneurism*. In order to the production of either of these diseases it is generally necessary that the injured vessels should be placed in immediate juxta-position, although there are some apparent exceptions to this rule, one of which has been already noticed\*—that the communication effected between them should be direct and free—and that subsequent inflammation should so far agglutinate all the adjacent and intervening structures as to prevent the blood from passing otherwise than between the two vessels. It may be added, that if there had been an external wound, it is necessary it should be healed, but its previous existence is by no means indispensable, for the vascular communication may evidently be established by ulceration, or by the bursting of a common circumscribed aneurism into an adjacent vein, and there is reason to believe that aneurismal varix may be produced by idiopathic disease. The fulfilment of so many conditions being requisite to the constitution of either disease will be sufficient to explain the infrequency of

\* Page 167.

both ; and this latter again may serve to shew why they have hitherto attracted so little attention, that their treatment is far from being determined. They may be found in any situation where an artery and vein lie in close proximity, but, for obvious reasons, will generally be met with at the bend of the arm as a consequence of phlebotomy.

It would be a most interesting speculation to inquire, whether the production of this disease, even as the result of injury, is always accidental, or whether there may not be some previous condition of the artery, or the vein, or both, absolutely indispensable. That the artery and vein are often wounded, particularly by ignorant bleeders and bone-setters in the country, cannot be denied, even at the present day, and it is at least probable, that such accidents were far more frequent formerly, when there was a much greater dearth of educated practitioners ; yet, aneurismal varix is now an uncommon disease, and if it ever had been otherwise must have been strangely overlooked. Perhaps there may be some fortuitous circumstances, connected with the size or the direction of a wound that may dispose to this particular result, and with which we are unacquainted, and thus the communication may be established between vessels in a normal and healthy state ; but I think there is something more—something in the vessels themselves—and, indeed, such must be admitted, if it is believed that the disease is ever idiopathic. Here I may notice a condition of artery and



vein that, if it does not occasionally produce this affection, seems strongly to predispose to its occurrence. Every anatomist is acquainted with the close adhesion that exists between the popliteal artery and vein in the adult male, an adhesion so frequent and so firm that it may almost be regarded as the natural condition of these vessels in such subjects; now, it must be quite obvious that, in the event of a perforating wound, such previously formed attachment will greatly facilitate the establishment of an aneurismal communication; and I have seen such attachment between the vessels in other situations, probably the result of chronic inflammation, often, for instance, in the thigh. I do not recollect that this condition of structure has been noticed by Scarpa, or other writers who have described the disease, they, generally, regarding it only as the result of injury, and so explaining its accidental formation between healthy vessels; but, let us admit for a moment the possibility of its being idiopathic, and such explanation must be evidently imperfect. On the other hand, in the event of ulceration attacking an artery in a spot corresponding with an adherent vein, it is not at all impossible but that a communication may thus be formed, and it is worth remarking, (although the observation of one person must be of little value until amply confirmed,) that I have never seen a fusiform dilation of an artery, the very state in which ulceration is likely to occur, that the accompanying vein was not firmly adherent to it.

In the winter of 1839-40, a case of subclavian aneu-

rism occurred in the Meath Hospital, in which the patient died suddenly, previous to the performance of any operation ; and, on examination, two separate and distinct fusiform dilations were found, both of which were so strongly adherent to the vein as to be separated with difficulty without laceration. And, more recently still, a case of mixed aneurism of the femoral artery was examined in the same hospital, in which the vein was so adherent to the dilated artery as to compress it along the entire line of attachment, and cause the expanded portion to assume an hourglass shape. These cases were seen by many, both practitioners and pupils, and the preparation of the latter is in the museum of the Royal College of Surgeons ; they are quite sufficient to prove the existence of this peculiar pathological condition of the vessels. How far a knowledge of this fact may assist in explaining the occasional occurrence of aneurismal varix is still uncertain, although, perhaps, deserving of farther inquiry ; but it is of the greatest importance to be aware of it in the performance of our operations on the arteries, and I shall, therefore, have occasion to recur to it, and to dwell on it more at length, when discussing that part of the subject.

I know not whether the older practitioners were generally unacquainted with aneurismal varix, but certainly it is at a comparatively recent period that we find it first accurately noticed and described. In 1758, the celebrated Dr. William Hunter asked, with the utmost sim-

plicity—"Does it ever happen in surgery when an artery is opened through a vein, that a communication or anastomosis is afterwards kept up between these two vessels?" And, in 1761, he published a memoir on the subject, including two cases (one of which gave occasion to the foregoing question) in which the symptoms of the disease are laid down with an accuracy and fidelity that have left little for subsequent observers, and a line of treatment suggested that it would have been well had it been universally adopted.

Since the attention of the profession was thus directed, its records have been enriched by the publication of a number of cases, and the disease now appears to be pretty well understood as to its symptoms and pathology; but I do not find any thing approaching to an unanimity of opinion as to its treatment—some having adopted the Hunterian operation—others that of cutting down upon the artery and tying it above and below the wound—and others still advocating the advantage, if not the necessity, of abstaining from any operation whatever. Such diversity of practice generally proves the existence of different stages, or at least different pathological conditions in any disease, and such may be the case here, as influenced by the producing cause of the vascular communication—if by a cutting instrument—by a gunshot wound, or similar injury—or by idiopathic ulceration: but I am not qualified by experience to enter extensively upon this discussion, and it will be seen

hereafter that the ideas I entertain lead me to be the advocate of the milder treatment—the follower of Hunter, who says “it will be best to do nothing.”

If the varix is the result of accident, the vein, very soon after its occurrence, appears to be dilated into a small tumour of an oblong shape, in the centre of which the cicatrix of the puncture is to be seen. This tumour is soft, yielding, and compressible: it diminishes in size, or if small, disappears altogether on pressure being made on the course of the artery above it: it is diminished also by pressure on the vein below it, but not in so remarkable a degree: but pressure on the vein above it, or in such direction as to impede the return of the blood, causes it to swell out and become prominent, and in many instances, occasions very considerable pain. On laying the finger on the tumour, a remarkable tremulous motion is felt, (as well as a considerable pulsation,) both in the sac and in the vein: these are strongest at the place where the vein was punctured, where they may be seen as well as felt, and become gradually less perceptible from that part upwards. On applying the ear, a peculiar whizzing or buzzing sound is heard, likened by Hunter to that produced by the passage of a blast of air through a small hole: but I think it resembles nothing so much as the noise made by the motion of a fly enclosed in a small paper bag. This jarring sound cannot be more accurately described, but once heard, will be easily recognised again: it is not, however, pathognomonic of, or peculiar to, aneurismal varix, for I have heard it in

situations where dissection after death proved the non-existence of any, the least communication between the artery and vein. For instance, in a man whose subclavian artery I tied for the cure of axillary aneurism, this sound was heard in every part of the body, where an artery and a vein lay in contact: I have observed a similar phenomenon in a young female, who had never been the subject of accident or operation, and in a few other examples also, but in none of these cases now alluded to was there any external tumefaction, (which seems to be an essential character of the disease,) neither was there any pain or inconvenience experienced. When the tumour is once formed, it generally increases, that is, the vein becomes enlarged, both in the direction of the current of its blood and the opposite, but much more freely and extensively in the former than in the latter. The rapidity of this growth depends on the size of the aperture leading from the artery into the vein, and the quantity of blood thrown into it at each contraction of the heart, and is generally very slow when formed by so small a wound as that inflicted by the lancet in bleeding: but a very different condition may be easily conceived where the communicating wound is large, such as would be formed by the bursting of a common circumscribed aneurism into an adjacent vein. In this latter case, although the enlargement of the vein might still be slow, yet eventually, it would be prodigious: in fact, there is no limit to its growth, until the limb becomes strangely deformed in appearance, all its veins being enlarged to the size of a man's thumb or more, knotted on each



other, twisted and irregular. Throughout their entire extent they remain soft and compressible; they are influenced by position, by bandage, by ligature on the limb, in like manner as if the disease was not present, and the peculiar jarring noise can be heard in every part of their entire extent—at a distance from, as well as near to, the seat of the communication between the vessels. The artery of the limb is enlarged, and pulsates strongly down to the spot where it had been wounded; below this it is diminished in size, and the pulse, in most instances, is scarcely perceptible.

Let us now, in order to arrive at the rational treatment of this affection, take a brief review of its pathology. It appears pretty clearly that most of the phenomena of aneurismal varix, such as the peculiar sensation to the touch and the jarring sound, are attributable to the meeting and mutual resistance of the two currents of blood, for they can be made to disappear by such pressure as will arrest either; but it is also obvious, that the forces of these currents are not equal—that the rush of blood is from the artery into the vein, very little, if any, of the contents of the latter passing into the former, and hence the symptoms of the disease, the swelling, the sensations of touch and sound, are most prominently developed in the vein. When the vein receives this additional quantity of blood, it must become proportionally distended at the moment, and the distention will become permanent in proportion to the resistance the newly introduced blood receives in its

circulation; hence we understand how the veins of the lower extremity may, under such circumstances, become rapidly and frightfully enlarged, those of the superior extremity much less so, and in the neck, where gravity favours the venous circulation, scarcely, if at all; we also understand how any thing which may tend to impede or prevent the rush of blood from the artery will arrest the increase of the deformity, but that nothing short of cutting out the enlarged vein, if such an operation could be entertained, even in imagination, would be effectual in removing it. As to the great characteristic of disease, pain, I believe it is seldom of any consequence in this; but I have met with some variety on this subject, one case in particular, of a very small varicose aneurism at the bend of the arm, of which the patient made loud complaints, and for which he even implored relief by operation. The only additional apparent evil, that of the existence of a mixed circulation in the vein, will be determined as to its nature and extent by the situation of the aneurismal varix; such a communication between any of the large vessels within the thorax must be destructive—even in the abdomen I should conceive it to be extremely prejudicial—but in the extremities, where the disease is most frequently found, and where we have most opportunities of observing it, I do not imagine it can occasion any very serious inconvenience,

It now only remains to discuss the treatment of this affection, and, if the view I have taken of its pathology

be correct, that may be easily disposed of. The tumour, once formed, cannot be removed, but its further growth and increase may be prevented in the great majority of instances—I say the great majority of cases, because I conceive, and think I have seen that in which no hope could be reasonably entertained from any practice. Several years since, a patient was admitted into the Charitable Infirmary, Jervis-street, with a popliteal aneurism, of the size of a child's head, and with all the veins of the limb, particularly of the thigh, enormously distended, so as to appear like ropes knotted and twisted under the integuments. In every one of these veins, the peculiar thrill and sound of aneurismal varix could be distinctly perceived. The account he gave of himself was this—he had a pulsating tumour in the ham for fourteen years previously, which gradually increased to its present size, until the veins began to swell, when the large tumour became stationary. He experienced but little inconvenience, and said he was able to walk eleven or twelve miles a day. He was frequently permitted to leave the hospital, and exhibited himself to several professional men for money ; in this way I had an opportunity of seeing him and examining the disease, in the school of Park-street. As he refused to submit to any treatment, and indeed, no operation held out a prospect of much benefit, he was soon discharged, and I never heard of him since. Now, if this was a case of varicose aneurism—if (as I believe) this had been originally a case of popliteal aneurism, that in process of time had burst into the vein, it is quite clear that it offered a spe-

cimen of the disease which it would have been most unwarrantable to meddle with. It is truly an extreme case, but, perhaps, not on that account less practically interesting.

But it appears there are some cases which may admit of surgical treatment, and we know that, occasionally, patients become clamorous for something effectual to be done. If we shall be satisfied with preventing an increase of the tumour, very moderate compression will be sufficient; but this treatment is purely palliative, and immediately on the compression being discontinued, the varix will commence to grow again. If our aim is *permanently* to check the disease, the abnormal current of blood must be stopped, and this can only be effected by the obliteration, either of the artery or of the vein, or of both, by inflammation. Now, in seeking either of these objects, a good deal of discrimination is necessary; and I believe it will be important to modify our views according to circumstances. In the simple aneurismal varix I have already said that the mildest treatment will be the best, and I should be satisfied with such a degree of compression as would merely control the disease; but in this, as in every other form of aneurismal affection, there are circumstances that may forbid the employment of pressure at all. The varix may be so situated that compression could not be applied—in the neck, for instance, or in the axilla; or, being applied, it may occasion a degree of torture that cannot be endured; or it may produce œdema or numbness of the limb—in short

the same objections may be raised to it that have been applied to compression generally.

Dupuytren is very decided in his reprobation of pressure ; he says it is very difficult to employ, very inconvenient in general, and, according to the seat of the affection, occasions dangerous swelling and intolerable pains : moreover, it is inefficacious in obliterating an old aperture, rounded off, and organised like the lining membrane of arteries and veins, circumstances in which the ligature itself almost always fails. Doubtless these observations are perfectly true—there are cases in which compression cannot be tried, and others in which it cannot be borne, but they are very few, and in considering this point, and in testing it practically hereafter, let us attach a definite meaning to the term. Dupuytren, and the other opposers of compression, speak of it as a *cure*-*tive* means—I, only as a *palliative* : they seek to stop the abnormal current of blood—I, only to moderate its force, and it is probable both parties are right. I know that, in some fortunate cases, compression has cured the disease ; but, nevertheless, I should not be disposed to place much confidence in it, and would never resort to it whilst I possessed the alternative of performing an operation less tedious and less painful.

These observations, however, only apply to the aneurismal varix, which I think may be always palliated unless in some particularly unfavourable situations ; but it is easy to conceive a case of varicose aneurism in



which an operation might become indispensable. If the aperture leading from the sac into the vein is of the same size as that leading from the artery, or if it is larger, then the blood can flow from the sac as freely and as fast as it is thrown into it—the sac never increases in size, the tumefaction is confined to the vein, and the case, in its pathology and treatment, is but slightly different from the aneurismal varix: this is fortunately the most frequent of occurrence; for the veins, lying more superficial, are generally the most extensively injured; but it is quite possible that the aperture leading from the sac may be less than that from the artery, and then some blood will remain within it, and become coagulated, and the aneurism will increase in size. Such a contingency as this is mentioned by Scarpa, and if it did occur, would, of course, require the operation. We see, then, that a surgeon may be compelled, either by the importunities of a patient, or by the nature of the case, to undertake an operation; and the point to be determined is as to what that operation must be. Dupuytren says that Hunter's operation always fails on account of the numerous anastomoses carrying the blood round to the seat of the aneurism; and the observation is a correct one, though not sufficiently explicit. The varicose aneurism is, as to the principle on which a cure is to be effected, precisely in a similar condition to the traumatic aneurism—that is, there is an aperture in the sac through which fluid blood can escape—the sac, therefore, can never be filled by a coagulum, or brought so to press upon the injured artery as to cause its obli-

teration. The Hunterian operation, then, will be a palliative, as long as it removes the impulse of the heart from the tumour: but the moment that impulse is re-conveyed, by the collateral circulation, it becomes completely useless. It may, therefore, be performed, and may appear to be successful in particular situations, but it is wholly inapplicable where an extensive collateral circulation exists—as, for instance, in the internal carotid. There only remains then the operation of cutting down on the artery, and tying it above and below the wound; and here I may offer a few observations on this operation, as derived from experience; for students, when they hear of the tying of an artery, are apt to consider all such operations as nearly alike, and capable of being performed with equal facility; but this one has difficulties and causes of embarrassment peculiar to itself, which can be more effectually explained now, in immediate connexion with the disease. First, then, if it be possible, the vein should be spared—it ought not to be cut into, or tied, or otherwise interfered with; and it is often no easy matter to avoid it; for you know it is distended and swollen, lying in general immediately in front of the artery, so that the operator must go round it, if he wishes to reach the latter vessel in safety. Another cause of difficulty is the hæmorrhage; it is always a bloody operation when the tumour has reached to any considerable size and happens to be opened; and, although the bleeding may not be such as to bring life into absolute peril, yet it always obscures the parts; and it is particularly difficult to obviate this

source of inconvenience ; for the same pressure that will control the flow of blood from the artery will encourage and increase that from the vein. These reasons will be quite sufficient to teach any operator the utmost caution in meddling with the vein. Suppose, now, that the surgeon has been able to expose the artery, he finds it almost constantly in an abnormal or unhealthy condition—very often it is dilated—always it is so firmly adherent to the vein, for an inch or more above and below the communicating aperture, that it cannot be separated by dissection, and the vein is greatly exposed to injury from the passage of the needle. Lastly, though it bears relation to a remote consequence of the operation, I may remark, that this very condition of the artery predisposes to secondary hæmorrhage ; and it is a practical fact that this calamitous occurrence very often happens after this operation. Seeing, now, that the only radical and permanent cure is to be obtained by this difficult and dangerous operation—that the operation of Hunter affords only a temporary relief—and that, in the vast majority of instances, the disease can be rendered tolerable by moderate compression, accompanied by due attention to regimen and diet, and the avoidance of every thing that can excite the circulation—it may be easily understood why I suggested, in the commencement of the chapter, that an acquaintance with this disease is of most value when it tends to prevent unprofitable or dangerous interference.









